ABSTRACTS OF NORTH AMERICAN GEOLOGY

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INTRODUCTION

Abstracts of North American Geology contains abstracts of technical papers and books and also citations of maps on the geology of North America including Greenland, the West Indies, as well as the State of Hawaii, Guam, and other island possessions of the United States. Articles of a general nature by North American authors are cited even though published in foreign journals, but those by foreign authors are included only if they appear in North American journals. Abstracts are prepared only of material that is believed to be generally available. Ordinarily abstracts are not published of material with small circulation (such as dissertations, open-file reports or memorandums) or of other papers presented orally at meetings.

The Abstracts is an additional reference tool but does not replace the Bibliography of North American Geology, which has been published by the Geological Survey since 1887. Twelve monthly issues of Abstracts of North American Geology are published each year. The Bibliography includes citations and subject index for a calendar year.

The numbers assigned to the abstracts in this publication are for reference in using the index; they are not order numbers. Publications cited here in abstract form are available in most geological libraries or through interlibrary loan.

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ABSTRACTS

02301 **Aitken, J. D.; Norford, B. S.** Lower Ordovician Survey Peak and Outram Formations, southern Rocky Mountains of Alberta: Bull. Canadian Petroleum Geology, v. 15, no. 2, p. 150–207, illus., 1967.

The stratigraphic nomenclature of Canadian (Lower Ordovician) strata of the southern Rocky Mountains of Alberta is revised. Two new formations—the Survey Peak and overlying Outram—are proposed. The four informal members of the Survey Peak apparently originated on a shallow, intermittently emergent sea bottom. The Survey Peak rests with abrupt but concordant contact upon the uppermost Cambrian Mistaya Formation. The origin of the Outram Formation in moderately shallow, poorly aerated marine waters is suggested. The Outram has conformable and gradational contacts with the Survey Peak below and the Skoki Formation above. The trilobite zonation of the Survey Peak and Outram is remarkably similar to the zonation established in Utah and Nevada.—*from* Authors' abstract

02318 **Akehurst, Alfred John.** The Jasper Formation, Jasper, Alberta [abs.]: Bull. Canadian Petroleum Geology, v. 15, no. 2, p. 214, 1967.

Akers, L. K. *See* Noakes, John E. 02204

Akers, Lawrence. *See* Noakes, John. 02345

Allen, Clarence R. *See* Brune, James N. 02049

02136 **Allen, J. R. L.** A beach structure due to wind-driven foam: Jour. Sed. Petrology, v. 37, no. 2, p. 691–692, illus., 1967.

A distinctive pattern of ridges and hollows produced by wind-driven sea foam passing over a surface of wet or moist sand may be preserved in the geologic record and serve as evidence of strand deposits.—EDM

01958 **Am. Assoc. Petroleum Geologists.** (Pacific Section). Sacramento Valley, Winters to Modesto, California: Am. Assoc. Petroleum Geologists Pacific Sec. Correlation Sec. 16, 1 sheet, 1967.

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01958 **Am. Assoc. Petroleum Geologists.** (Pacific Section). Sacramento Valley, Winters to Modesto, California: Am. Assoc. Petroleum Geologists Pacific Sec. Correlation Sec. 16, 1 sheet, 1967.

11132 **Am. Geological Institute.** Geoscience abstracts, V. 8, Nos. 1–12: Washington, D. C., Am. Geol. Inst., paged separately, 1966; Index, ibid., Pt. 2, 349 p., 1966.

02392 **Amsden, T. W.; Boucot, A. J.; Johnson, J. G.** *Conchidium* and its separation from the subfamily Pentamerinae: Jour. Paleontology, v. 41, no. 4, p. 861–867, illus., 1967.

Conchidium bilocularis Hisinger, the type species, bears relatively short outer plates and a pair of medially directed flanges at the bases of the brachial processes, a structure that allies it to *Cymbidium*. The new genus *Kirkidium* has long thin smoothly merging inner and outer plates as in *Pentamerus*. These structures divide the Pentameridae into two subfamilies, herein emended: Subrianinae (including Conchidium and Cymbidium) and Pentamerinae; Virgianinae, although first proposed as a family, is here included as the third subfamily of Pentameridae. The pentamerid subfamily Gypidulinae is elevated to family rank.—REG

02017 **Anderson, Duwayne M.; Reynolds, Robert C.** Umiat bentonite—An unusual montmorillonite from Umiat, Alaska: U.S. Army Materiel Command Cold Regions Research and Eng. Lab. Research Rept. 223, 11 p., illus., tables, reprinted 1967; originally published 1966.

This is a reprint of the paper in American Mineralogist, v. 51, nos. 9–10, p. 1443–1456, 1966. (See Abstracts of North American Geology, May 1967.)—ESL

Anderson, Jay. *See* Jacobson, Norman, 01930

02396 **Andrews, Harold E.** Middle Ordovician conodonts from the Joachim Dolomite of eastern Missouri: Jour. Paleontology, v. 41, no. 4, p. 881–901, illus., table, 1967.

Acid residues of dolomite and limestone samples yielded well-preserved specimens of 18 genera and 27 species. Only one species, *Ozarkodina joachimensis*, is new. The neurodontiform genera *Erismodus, Cardiodella, Trucherognathus, Curtognathus, and Polycaulodus* characterize the fauna. *Erismodus* is redefined to include species formerly assigned to *Microcoelodus and Ptiloconus*. Faunal study indicates a transition series from symmetrical (*Erismodus*) to asymmetrical elements (*Microcoelodus*). This series is demonstrated by a gradation in element symmetry within a single Joachim sample and by symmetry characteristics of *Erismodus* elements in faunas from the Dutchtown Formation, Joachim Dolomite, and Plattin Limestone. Uniqueness of the fauna makes regional correlation difficult.—*from* Author's abstract

02411 **Andrews, J. T.; Barry, R. G.** Zamechaniya po povodu stat'i ob otstupanii amerikanskogo lednika [discussion of paper by N. R. Malkin, 1966]: Vses. Geog. Obshch. Izv., v. 99, no. 3, p. 230–231, 1967.

The main point of the recent paper by Malkin (ibid., v. 98, no. 4, p. 326–332, 1966), that the periglacial lakes of North America would have strongly influenced the paths of cyclones and their generation, is extremely debatable in the light of recent investigations (including radiocarbon dating and tracing of moraines). It is shown that at the time of the Cochrane–Cockburn–McAlpine stage, the ice covered an area of 3.7×10^{12} m^2, and it seems very unlikely that local sources of moisture could have been the cause of a recurrence of ice advance as Malkin suggested. The absence of a similar stage in Europe does not indicate that the Cochrane could not have been caused by changes in general atmospheric circulation.—DBV

11130 **Appleman, D. E.; Boyd, F. R., Jr.; Brown, G. M.; Ernst, W. G.; Gibbs, G. V.; Smith, J. V.** Short course on chain silicates, held under auspices of the American Geological Institute, Palo Alto, Calif., Nov. 1966: Washington, D. C., Am. Geol. Inst. [separately paged lectures], illus., tables [1966?].

These lecture notes are designed to assist conference participants in following the ideas presented at the second venture of the American Geological Institute in post-university education. The latest research findings on sheet silicates, principally on pyroxenes and amphibolites, are described; their phase relations and crystal chemistry and structure are discussed, both from experimental tests and in natural

occurrence and paragenesis in igneous and metamorphic rocks. Some applications are made to pyroxenes from kimberlite. A few analytical methods are reviewed.—GDC

02259 **Archer, A. R.** Geochemical prospecting in the Ketza River district: Western Miner, v. 40, no. 4, p. 29–37, 1967.

Lead-zinc deposits of the Tintina trench contain silver in veins and massive replacement deposits. Geochemical prospecting by soil samples on a grid system located all significant areas of mineralization.—ARK

02036 **Asquith, George Benjamin.** The marine dolomitization of the Mifflin Member, Platteville Limestone in southwest Wisconsin: Jour. Sed. Petrology, v. 37, no. 2, p. 311–326, illus., 1967.

The Mifflin changes from limestone to dolomite eastward from the type locality south of Platteville, Wis.; interference ripple marks, scour and fill, and rip-up structures indicate that it was deposited in a very shallow epicontinental sea. Petrographic analysis is used to subdivide the Mifflin into a biomicrite facies on the west, a biosparite facies in the middle, and a dolomitized biomicrite facies on the east. Dolomite is restricted to the crest of the structural high known as the Wisconsin arch. This structure caused formation of a carbonate shoal or bar behind which was a semi-restricted shallow lagoon with conditions favorable for dolomitization. There were two stages of marine dolomitization, an early diagenetic, and most extensive, and a penecontemporaneous. In addition there was hydrothermal dolomitization associated with lead-zinc mineralization.—*from* Author's abstract

Avrett, J. R. *See* Newton, J. G. 11218

11220 **Ayala-Castañares, A.** Investigaciones sobre foramíniferos recientes de México: Soc. Mexicana Historia Nat. Rev., v. 27, p. 7–21, illus., 1966.

Fossil Foraminifera have been studied in Mexico since 1919, with special reference to petroleum exploration; a history of this study is summarized. Living Foraminifera of Mexico have been studied much less—before 1959 only by foreign investigators, but since then also by Mexican scientists of the Instituto de Geología de la Universidad Nacional Autónoma de México, under its marine sciences program, which so far has been restricted mainly to studies of coastal lagoons and reefs. Ecologic and sedimentation studies involving Recent Foraminifera are discussed briefly for 15 areas of the Pacific Ocean, Gulf of California, and Gulf of Mexico. In addition, experimental work is being carried out by the Instituto de Geología and by Scripps Institute of Oceanography. A reference list of publications and manuscripts in preparation is appended.—VMJ

Baadsgaard, H. *See* Hills, L. V. 02299

Baerreis, David A. *See* Bender, Margaret M. 02227

02175 **Baird, Donald; Carroll, Robert L.** *Romeriscus*, the oldest known reptile: Science, v. 157, no. 3784, p. 56–58, illus., 1967.

The description of *Romeriscus*, a new genus of limnoscelid reptile, is based on a partial skeleton from the Early Pennsylvanian (Westphalian A) of Nova Scotia. Although it is the earliest and most primitive reptile yet known, it is probably already too late and too specialized to be ancestral to the more advanced Carboniferous and Permian captorhinomorphs and pelycosaurs.—Authors' abstract

02035 **Ball, M. M.** Carbonate sand bodies of Florida and the Bahamas: Jour. Sed. Petrology, v. 37, no. 2, p. 556–591, illus., table, 1967.

Sand bodies of the Florida-Bahamas area are classified as marine sand belts, belts of tidal bars, eolian ridges, and platform interior sand blankets. Each type has its own characteristic relationship of the following descriptive attributes: setting, geometry, internal structure, composition, and texture. The bottom topographic

setting, through its influence on currents, controls sand body geometry, internal structure, composition, and texture. Sand bodies once formed are themselves bottom topographic features that influence the character of associated sediment accumulations and may, by means of a feedback mechanism, exert some influence on their own characteristics. Reconstruction of regional topographic setting at time of deposition is an important step in establishing distribution of sand bodies within a formation.—*from* Author's abstract

Banks, H. P. *See* Matten, L. C. 02406

Banks, Harlan P. *See* Bonamo, Patricia M. 11184

Banks, Harlan P. *See* Matten, Lawrence C. 11212

Baptie, B. *See* Ogilvie, R. T. 02239

01997 **Barbat, William N.** Crude oil correlations and their role in exploration: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 7, p. 1255–1292, illus., table, 1967.

Correlation indexes and the sulfur and nitrogen content of crude oils permit correlation between oils and source rock. Paraffinic crudes are related to oxidizing source conditions, aromatic asphaltic crudes are related to euxinic source conditions, and highly nitrogenous crudes are related to phosphatic source rocks. Thermal-cracking in deep-seated oil changes these factors drastically, so that correlation of deep-seated distillates may not be feasible. Petroleum characteristics appear to change little during long-distance migration. WCC

02031 **Barnes, Harley; Christiansen, Robert L.** Cambrian and Precambrian rocks of the Groom district, Nevada, southern Great Basin: U.S. Geol. Survey Bull. 1244-G, p. G1–G34, illus., tables, 1967.

More than 14,000 feet of conformable Cambrian and Precambrian rocks is exposed in the Groom district in southwestern Lincoln County. The lower half of this section is chiefly quartzite and siltstone, the upper half chiefly limestone and dolomite. Included are part of the Johnnie Formation and the Stirling Quartzite of Precambrian age; the Wood Canyon Formation of Cambrian and Precambrian age; and the Zabriskie Quartzite, Carrara Formation, Bonanza King Formation, and Nopah Formation of Cambrian age. The stratigraphic units exposed in the Groom Range can be recognized for more than 100 miles to the west and south, and can be correlated with the Cambrian and Precambrian rocks of the Pioche district, although different nomenclature is preferred for the Pioche area.—*from* Authors' abstract

01962 **Barnes, Ivan; LaMarche, V. C., Jr.; Himmelberg, Glen.** Geochemical evidence of present-day serpentinization: Science, v. 156, no. 3776, p. 830–832, tables, 1967.

Ultrabasic (pH > 11) water issues from some fresh ultramafic bodies. The properties of the ultrabasic solutions are believed to be due to current reactions yielding serpentine from primary olivines and pyroxenes. The low concentrations of divalent iron, divalent magnesium, and dissolved silica from the serpentinization require an increase in rock volume.—Authors' abstract

Barry, R. G. *See* Andrews, J. T. 02411

02061 **Barss, M. S.** Illustrations of Canadian fossils—Carboniferous and Permian spores of Canada: Canada Geol. Survey Paper 67-11, 94 p., illus., 1967.

This report illustrates assemblages of miospores from Yukon Territory, Northwest Territories, and the Maritime Provinces of Canada. Thirteen assemblages from Carboniferous and Permian rocks are shown on 38 plates with 918 photomicrographs. Each plate is accompanied by provisional taxonomic identifications and brief statement of stratigraphic provenance of the fossils. Most of the fossils have not been previously figured.—Author's abstract

Bartlett, Alexandra. *See* Langenheim, Jean. 01937

11200 **Bates, Robert L.** Geology of cement raw materials in Ohio—A summary, *in* Symposium on geology of cement raw materials—Forum on geology of industrial minerals, 2d, 1966, Proc.: Bloomington, Ind., Indiana Geol. Survey and Indiana Univ., p. 23–29, illus. [1966?].

The principal cement raw materials in Ohio are five limestone formations. The basal Silurian Brassfield is used by two plants in the southwest. Stone from the upper part of the Columbus Limestone, Middle Devonian, is obtained from a deep mine at Barberton in the northeast. Upper beds of the Dundee Limestone and the lower part of the overlying Silica Formation supply two plants in the northwest. Maxville Limestone, Upper and Middle Mississippian, is mined near Zanesville for one plant, and at Ironton on the Ohio River for two others. A thin Pennsylvanian limestone, the Putnam Hill, is quarried to supply a plant in northeastern Ohio. The Pennsylvanian Vanport Limestone, long a cement raw material, is no longer used.—*from* Author's abstract

02179 **Battjes, J. A.** Quantitative research on littoral drift and tidal inlets, *in* Estuaries (edited by George H. Lauff): Am. Assoc. Adv. Sci. Pub. 83, p. 185–190, illus., 1967.

This paper gives an account of quantitative research on problems of littoral drift and tidal inlets in progress or in preparation at the Coastal Engineering Laboratory of the University of Florida. Attention is confined to tidal inlets of sandy coasts with littoral drift, focusing on sand drift along shore, sand transport through the inlet, interplay of both in the inlet regime, and resulting stability of the inlet. In laboratory tests, two main problems are being investigated: littoral drift waves and currents running perpendicular to each other and inlet channel waves and currents running with or against each other. Quantitative formulas represent the parameters of stability characteristics.—GDC

02125 **Baxter, James W.; Desborough, George A.; Shaw, Chester W.** Areal geology of the Illinois fluorspar district—Pt. 3, Herod and Shetlerville quadrangles: Illinois Geol. Survey Circ. 413, 41 p., illus., table, geol. map, 1967.

This report and map of the Herod and Shetlerville quadrangles complete the geologic remapping of the Illinois fluorspar district. Twenty-nine Lower Devonian to middle Pennsylvanian sedimentary rock units and two Pleistocene units are differentiated on the map. The Hicks Dome is located on the axis of a large domal anticline and lies between two northeast-southwest trending grabens—the Rock Creek graben and the Dixon Springs graben; the strata are marked by numerous faults and fractures. Intrusive igneous rocks consist of mica peridotite dikes, lamprophyric dikes, and intrusive breccias. Some of the faults and breccias are mineralized, principally with fluorspar. Fluorspar and limestone have been produced in the area and coal seams have been prospected locally.—LLP

02160 **Bayrock, L. A.; Pawluk, S.** Trace elements in tills of Alberta: Canadian Jour. Earth Sci., v. 4, no. 4, p. 597–607, illus., table, 1967.

Analysis of 475 Keewatin till samples from the Alberta Plains shows well-defined trends in the distribution of certain minor constituents and trace elements. Fe and Cu are most abundant in tills from the Clear Hills region of northwestern Alberta, in which area thin but widespread beds of iron formation outcrop. Zn distribution in till also is related to bedrock composition and, together with Fe and Cu, is useful in delineating bedrock subcrop patterns. The distribution of CaO, although related to the carbonate content of the underlying bedrock on a regional scale, has been modified to some extent by glacial processes, as demonstrated in the Caribou Mountains area of northernmost Alberta.—Authors' abstract

Beales, F. W. *See* Wolf, K. H. 02100

02076 **Beck, George L.; Dunn, John R.** A preliminary report on the Muav aquifer, Grand Canyon, Arizona [abs.]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 97, 1967.

02087 **Beck, George L.** Quantitative analysis of the Muav aquifer, Grand Canyon National Park, Arizona [abs.]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 105–106, 1967.

02262 **Beck, L. S.** Uranium developments in Saskatchewan: Canadian Mining Jour., v. 88, no. 4, p. 126–129, 1967.

Two main types of uranium deposits are veins of pitchblende in faults, and deposits of uraninite in pegmatitic, gneissic, and migmatitic rocks. Since deposition, uraninite bearing deposits have remained "closed" with low mobility of lead, but pitchblende deposits have been reworked or rejuvenated several times by tectonic-thermal events.—ARK

Beckmann, Douglas D. *See* Picard, M. Dane, 02123

01931 **Beebe, B. Warren.** Quest for unity—[Pt.] 2, The anemic prodigy: Geotimes, v. 12, no. 6, p. 21–22, illus., 1967.

The second in a series on the history of the American Geological Institute covers the period from its birth in 1948 to 1959. During this period AGI suffered from lack of support and complete lack of communication with the member societies. First an evaluation committee and then a reorganization committee were appointed. The latter was divided into a small executive group and a larger steering committee.—ESL

11195 **Beets, D. J.** Stratigraphic position and age of a Cretaceous ammonite from Curaçao, Netherlands Antilles: Kyushu Univ. Fac. Sci. Mem., Ser. D, Geology, v. 17, no. 3, p. 287–294, illus., geol. maps, 1966.

This paper is an appendix to the paper by T. Matsumoto (ibid., p. 277–286, 1966), in which he identifies the first ammonite found on Curaçao, West Indies. Stratigraphic relations of the Upper Cretaceous to lower Tertiary eugeosynclinal sequence of central Curaçao are shown on geologic maps and sections. The sequence consists of the Curaçao Lava Formation, the sedimentary Knip Group, and the Midden Curaçao Formation, a turbidite. The Mameter Formation, in which the ammonite was found, is one of eight formations of the Knip Group; because lateral facies changes are largely obliterated by faulting, correlation in the Knip is mainly lithologic. Pseudorbitoid foraminifers in limestone lenses at base of the Mameter were considered upper Campanian or Maestrichtian by Bronnimann (1955); the formation and the ammonite are probably within this age range.—VMJ

02014 **Bell, G. L.** Big potential oil basins offshore from west coast: Oilweek, v. 18, no. 19, p. 48–51, 53–56, 1967.

Typically elongated basins off the coast of British Columbia, with structurally complex thick Tertiary and Cretaceous sedimentary sections, appear analogous to prolific oil basins along the California coast. Three areas are considered prospective: Queen Charlotte Sound–Hecate Strait, Georgia Strait, and Juan de Fuca Strait–Westcoast shelf. The stratigraphic sequences, lithology, and structural features are presented; reported tar seeps are confined to volcanic strata. Major fault zones are related to fundamental crustal fractures of the continental margin, main faults to boundaries of basement uplifts, and oblique trends in southern Vancouver Island to Tertiary deformation. Knowledge is insufficient for realistic estimates of potential oil reserves; an initial estimate of eight billion bbl may prove far too conservative.—GDC

Bell, Henry, 3d. *See* Carolina Geological Society, 11127

01912 **Belyea, Helen; Best, E. W.** Calgary—Its geologic setting: Geotimes, v. 12, no. 6, p. 10–13, illus., 1967.

Calgary, Alberta, is just east of the axis of the Alberta syncline, near the western edge of the Western Canada Sedimentary basin. The outstanding structural feature of the southeastern Cordillera is the décollement on major low angle overthrusts. Under the city, bedrock dips slightly west and consists of 5,100 feet of Paleozoic,

5,600 feet of Cretaceous, and 1,800 feet of Tertiary. At least five tills have been deposited in the area. Calgary is the center for exploration and production of Canadian oil and gas, and production from four different formations has been developed within the city.—ESL

02227 **Bender, Margaret M.; Bryson, Reid A.; Baerreis, David A.** University of Wisconsin radiocarbon dates III: Radiocarbon, v. 9, p. 530–544, 1967.

Summarized are C-14 dates obtained since November 1965 on archeologic samples from Texas, Oklahoma, Wisconsin, Nebraska, Missouri, Ecuador, Mexico, and Japan; and on geologic samples from Northwest Territories, Manitoba, Louisiana, and Colorado.—MCM

01953 **Benfer, Richard H.** Project Pre-SCHOONER II—Apparent-crater studies: U.S. Atomic Energy Comm. Rept. PNE-508 (Final Rept.), 32 p., illus., tables, 1967.

The Pre-SCHOONER II detonation of 85.5 tons of nitromethane at a depth of burst of 71 feet in hard, dry rhyolite rock, about 40 miles southwest of Bruneau, Idaho, produced a symmetrical and smooth crater with the average profile approximately hyperbolic. Aerial stereophotogrammetric mapping and conventional field survey techniques were used to determine its radius of 95.2 feet and depth of 60.7 feet. These were 27 percent wider and 53 percent deeper than the values predicted using basalt cratering curves, which indicates significantly different cratering characteristics. The apparent crater volume is 24,780 yd^3. The maximum missile range compared favorably with previous data for basalt.—GDC

Bennett, G. *See* Brown, D. D. 02381

02383 **Bennett, G.; Brown, D. D.; George, P. T.; Leahy, E. J.** Operation Kapuskasing: Ontario Dept. Mines Misc. Paper MP-10, 98 p., illus., tables, 1967.

In the Kapuskasing Moosonee area of Ontario, Archean mafic and felsic rocks intrude folded Precambrian complexes. North-centrally, granulite facies, uncommon in the Superior Province, underlie a wedge-shaped zone correlating with the Fraserdale-Moosonee aeromagnetic anomaly. A parallel gravity high to the west indicates upwarp and thinning in the Earth's crust. Associated with the uplift and northeast-striking faults are Proterozoic carbonatite intrusions containing columbium, copper and iron, and lamprophyric to kimberlitic intrusions of Devonian age. The kimberlite could be a source of diamonds. Generally flat Paleozoic and Mesozoic sedimentary rocks underlie the northern area; the whole is blanketed with Quaternary sediments. Base metals and other mineral occurrences are reported. A section on industrial minerals by G. R. Guillet is cited separately.—GDC

Bennett, Richmond. *See* Haynes, C. Vance, Jr. 02211

02333 **Benninghoff, William S.; Stevenson, Anne L.** Pollen analysis of cave breccia from Ladds locality, Bartow County, Georgia: Georgia Acad. Sci. Bull., v. 25, no. 3, p. 188–191, table, 1967.

Two samples contained 2,835 and 1,756 fossil pollen grains per gram of dry sediment. This sparsity indicates either rapid accumulation of mineral matrix, thus diluting the pollen, or transport, as by running water, with losses enroute. The pollen spectrum is dominated by pine, with moderate spruce; as both are resistant to decay, they may be residues of a more diverse spectrum or may be reworked from older Pleistocene beds. There are no other tree pollens. Pine has little indicator value here; but spruce, now occurring no nearer than western North Carolina at higher altitudes, indicates a cooler climate in the past. Four kinds of Compositae pollen, also resistant, suggest grassland or pioneer plant communities; however, high incidence of damaged grains and absence of other expected pollen indicate low reliability for paleoecologic interpretations based on pollen only.—VMJ

02270 **Benson, Richard H.** Muscle scar patterns of Pleistocene (Kansan) ostracodes, *in* Essays in paleontology and stratigraphy—R. C. Moore Commemorative Volume: Kansas Univ. Dept. Geology Spec. Pub. 2, p. 211–241, illus., table, 1967.

Fresh water ostracodes are studied from the Pleistocene Sappa Formation in Kansas associated with the Pearlette Ash bed, which marks the boundary between the Kansan glacial and Yarmouthian interglacial deposits. The faunas above the ash bed differ from those below it in sections examined from several localities. This difference may reflect ecologic succession within ponds or, possibly, warming of the climate. The faunas contain 16 species, including 10 of *Candona, and Cypricercus tuberculatus*, an index fossil for late Kansan and Yarmouthian deposits; other Neogene index species in the High Plains are discussed. As an aid in identifying the species, a new quantitative graphic method, the Theta Rho Analysis, here described, was used successfully for comparing carapace outlines and positions of muscle scars. VMJ

02225 **Berger, Rainer; Libby, W. F.** UCLA radiocarbon dates VI: Radiocarbon, v. 9, p. 477–504, illus., 1967.

Measurements reported were carried out during 1966 in the Isotope Laboratory at the University of California at Los Angeles on archeologic historic samples from the United States, Mexico, South America, Pacific and the Far East, Europe, Egypt, and Africa. Geophysical, geological climatological and biological measurements were made in the following categories: (1) C 14 in atmospheric carbon dioxide (California); (2) bomb C 14 in human tissues; (3) oceanic (seawater and shells, California); (4) vegetation and climate (Panama, California, Nevada); and (5) geologic processes (California, Israel). MCM

01949 **Berggren, William A.; Olsson, Richard K.; Reyment, Richard A.** Origin and development of the foraminiferal genus *Pseudohastigerina* Banner and Blow, 1959: Micropaleontology, v. 13, no. 3, p. 265–288, illus., tables, 1967.

The planispiral genus *Pseudohastigerina* Banner and Blow, 1959, is considered to be the earliest member of the subfamily Hantkenininae. *Pseudohastigerina wilcoxensis* (Cushman and Ponton) evolved in the earliest Eocene from *Globorotalia chapmani* Parr by the gradual migration of the aperture to an equatorial position and the concomitant development of planispiral coiling. The *Pseudohastigerina* datum is proposed and based on this evolutionary event, and it has been found useful in biostratigraphic studies in recognizing the Paleocene Eocene boundary. A new species, *Pseudohastigerina sharkriverensis*, is described from the lowest Middle Eocene of New Jersey. A biometric analysis of populations of *P. wilcoxensis, P. sharkriverensis, and Globigerinelloides messinae* (Bronnimann), an upper Maestrichtian species, reveals a marked degree of homeomorphy. Authors' abstract

02190 **Berner, Robert A.** Diagenesis of iron sulfide in Recent marine sediments, *in* Estuaries (edited by George H. Lauff): Am. Assoc. Adv. Sci. Pub. 83, p. 268–272, illus., 1967.

The term hydrotroilite has been used frequently for the black, fine grained iron sulfide in many Recent sediments. Four examples of different chemical formulas used for this substance are discussed. Its transformation to pyrite requires elemental sulfur and may be limited by the availability of this element. Air oxidation of H_2S or FeS at an interface between overlying oxygen rich sea water and the reduced sediment is one source. Tidal fluctuations and borrowing organisms would promote this process on tidal flats. Many sediments in which pyrite is found do not contain hydrotroilite, such as the diatomaceous muds of the Santa Barbara basin, Calif. In similar sediments on the west slope of the Gulf of California, this may be due to a slower rate of deposition than in deltaic environments. GDC

02207 **Berry, Frederick A. F.** 1951–1966 Advances and future problems of the geology of petroleum: Mtn. Geologist, v. 4, no. 3, p. 95–98, 1967.

In the last fifteen years, advances in petroleum geology have involved hydrodynamic investigations of flow systems, organic geochemistry, low temperature geochemistry, techniques for determining petroleum accumulation, gravity anomalies, radiometric surveys, the origin, migration, and accumulation of petroleum, deposition environments, diagenesis and alteration, origin of water and dissolved minerals, rock fluids, and transmissive properties. Problems that still exist involve the relation of anomalies to petroleum accumulation, primary petroleum migration, relative

abilities of gas and oil to migrate, organic source material, environments, interactions of petroleum with rock types, and predicting migration paths and accumulation of petroleum.—LLP

02400 **Berry, William B. N.** Monograptids from the McAdam Formation (Silurian), Nova Scotia: Jour. Paleontology, v. 41, no. 4, p. 965–969, illus., 1967.

The McAdam Formation (Silurian, Nova Scotia) has yielded three species of monograptids. Two species, *Monograptus* cf. *M. varians* Wood and *M.* sp. of the *M. chimaera* (Barrande) type indicate an early Ludlow age. The third species, from a higher stratigraphic level, is described here as *M. fritschi* cf. var. *linearis* Boucek; it suggests correlation with the British *Monograptus leintwardinensis* Zone. Earlier identifications of these species had led to assignment of a greater age; the present study suggests that the graptolite bearing part of the McAdam Formation ranges in age from early to probable middle Ludlow.—*from* Author's abstract

11187 **Berthelsen, A.** Comments on the tectonic map of Greenland, *in* Scientific communications read to the Commission for the Geological Map of the World: Paris, Internat. Geol. Cong., p. 13–16, illus., table, 1966.

The scale of the Tectonic Map of North America, of which this will form a part, is such that no local divisions could be shown within the narrow ice free region. Features have been selected to agree with the legends of the rest of the map. A correlation chart for Precambrian suprastrata and geosynclinal rocks and a table of isotopic dates on Precambrian minerals and rocks are included. Ten divisions of strata and rock units are outlined from fold belts older than Kenoran to Quaternary inland ice. The usual division into three structural stages in the fold belts has been followed wherever possible.—ESL

Best, E. W. *See* Belyea, Helen, 01912

02351 **Bicker, Alvin R., Jr.** Preliminary investigation of the ground-water resources of Copiah County, *in* Mississippi Water Resources Conf. 1967, Proc.: State College, Miss., Water Resources Research Inst., Mississippi State Univ., p. 13–20, illus., tables, 1967.

In Copiah County, the Oligocene Forest Hill Formation is the oldest stratum from which water is produced at present, but aquifers in the Miocene Catahoula are the most widely used. All terrace deposits are considered to be Pleistocene Citronelle; many domestic wells produce from this. A geologic sketch map and chart show relations of these formations. Water levels appear to have declined slightly in the last ten years.—ESL

02088 **Bicking, Lewis A.** Preliminary report on the Friars Hole karst [abs.]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 106, 1967.

02319 **Bielenstein, Hans Uwe.** The Miette Formation, Jasper, Alberta [abs.]: Bull. Canadian Petroleum Geology, v. 15, no. 2, p. 214–215, 1967.

Bien, George S. *See* Hubbs, Carl L., 02219

11204 **Biggs, Donald L.** Composition of dolomites in carbonate rocks used as concrete aggregates, *in* Symposium on geology of cement raw materials—Forum on geology of industrial minerals, 2d, 1966, Proc.: Bloomington, Ind., Indiana Geol. Survey and Indiana Univ., p. 101–110, illus., table [1966?].

Chemical analyses of dolomite concentrates from carbonate rocks show that iron is a common substituent in the dolomite crystal. X-ray diffraction patterns from such dolomite crystals are characterized by high background when the diffracted radiation used is CuK and by variable spacings d_{104}. The chemical analyses and unit cell constants derived from X-ray diffraction patterns are given for one series of determinations. Though no ankerites occur, a few ferroan dolomites examined approach that composition.—Author's abstract

02152 **Biggs, Robert B.** The sediments of Chesapeake Bay, *in* Estuaries (edited by George H. Lauff): Am. Assoc. Adv. Sci. Pub. 83, p. 239–260, illus., tables, 1967.

The deeper waters of Chesapeake Bay are periodically oxygen deficient. To determine the processes of sedimentation and early diagenesis in this estuarine area, 120 coring stations were located near Solomons, Md., where a deep trough of black sediments is marked by depletion of oxygen during the summer. Measured parameters and inferred causes are tabulated. Black sediment underlain by gray pyritiferous material is the result of troilite precipitation in oxygen-starved waters. When this is converted to pyrite the sediment becomes gray. Restricted banded occurrences result in alternating oxygen-poor and oxygen-rich waters. Some gray sediments in the shallow western part of the area contain no pyrite, indicating no troilite precipitation. In the future geological record, deep-water Chesapeake Bay sediments may be characterized as gray-green organic shales.—GDC

02012 **Bik, M. J. J.** On the periglacial origin of prairie mounds, *in* Glacial geology of the Missouri Coteau—Midwest Friends of the Pleistocene, Field Conf. 1967, Guidebook: North Dakota Geol. Survey Misc. Ser. 30, p. 83–94, 1967.

Prairie mounds or till and silt mounds are a common glacial feature of southern and central Alberta and southern Saskatchewan. A periglacial origin for the mounds is inconsistent with the contraction theory of ice wedge formation. Theories of supraglacial and subglacial origins have been unable to explain all characteristics of the mounds. Therefore, a theory of pingo formation combined with subsurface displacement of plastic material is offered and supported by similar collapsed pingos of western Europe.—LLP

Bissell, Harold J. *See* Chilingar, George V. 02099

02074 **Black, Douglas F. B.** Geologic map of the Coletown quadrangle, east central Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-644, scale 1:24,000, section, text, 1967.

In the Coletown quadrangle vein minerals include barite, fluorite, calcite, and sphalerite, their thicknesses ranging from several inches to six feet. Bedrock consists of limestone, dolomite, siltstone, and their shaly varieties. Several units have been quarried for limestone on a small scale. Blasting is required for excavation of hardrock units whose soil thickness is variable; rock of shaly units can be ripped by earth-moving equipment. Bedrock bearing strength of all units is high, but slope stability presents problems in the shaly units. Faults are not known to have been active in historic time, and generally, rock adjacent to them is not badly crushed. Sinkholes occur throughout the area and underground caverns must be located by drilling. Solution in limestone is generally most pronounced along breaks such as faults and joints.—MCM

Blake, W., Jr. *See* Lowdon, J. A. 02216

02346 **Blander, M.; Katz, J. L.** Condensation of primordial dust: Geochim. et Cosmochim. Acta, v. 31, no. 6, p. 1025–1034, illus., tables, 1967.

Calculations of the condensation path of a cooling gas of solar composition are presented which bear on the production of primordial dust, which was the precursor of the meteorites and planets. The results, which take into account barriers to nucleation, indicate that the primordial dust had much more variability of composition and form than previously assumed; this raises the possibility that some of the properties of meteorites which have been ascribed to a complex sequence of processes in a planetoid are in reality of a much more primitive origin associated with the primary condensation.—DBV

02026 **Blatt, Harvey.** Original characteristics of clastic quartz grains: Jour. Sed. Petrology, v. 37, no. 2, p. 401–424, illus., tables, 1967.

Quartz from disintegrating gneiss, schist, and massive plutonic igneous rock in desert environments has more similarities than differences. The igneous and metamorphic terranes all yield polycrystalline and monocrystalline particles, and particles either

with or without undulatory extinction. However, proportions of quartz grain types derived from different rocks vary with grain size. Polycrystalline quartz grains from gneiss contain generally finer quartz crystals than do similar grains from schist and plutonic rocks. Quartz crystals in polycrystalline grains in gneiss and schist commonly show preferred orientation and frequently fall into bimodal size distributions; however, intragranular suturing and moderate grain elongation are not reliable indicators of provenance. Quartz grains are reduced significantly in size by sedimentation processes.—RAC

01980 **Bluemle, John P.; Faigle, George A.; Kresl, Ronald J.; Reid, John R.** Geology and ground water resources of Wells County—Pt. 1, Geology: North Dakota Geol. Survey Bull. 51, pt. 1 (North Dakota Water Comm. County Ground Water Studies 12), 39 p., illus., tables, geol. map, 1967.

Wells County, on the eastern flank of the Williston basin, is underlain by 4,000–6,000 feet of Paleozoic and Mesozoic rocks that dip gently to the west. Uppermost Cretaceous rocks lie directly beneath the glacial drift which covers the entire area and averages 100 feet in thickness. The northern two-thirds of the county lies within the Drift Prairie with its moraines, outwash plains, meltwater trenches, and ice disintegration ridges; the southern third, part of the Missouri Coteau, is characterized by a hilly surface on dead ice moraine with kames, lake plains, and areas of collapsed outwash topography. When the late Wisconsinan glacier stagnated as a result of lobation, it was dissected by streams that deposited ice-contact ridges. Most important economic resources are soil, water, sand and gravel; further exploratory drilling for petroleum may prove successful.—*from* Authors' abstract

Boardman, Richard S. *See* Merida, Jesse E. 01960

11207 **Bobrowski, G. S.** Application of X-ray emission and diffraction to raw materials exploration, *in* Symposium on geology of cement raw materials—Forum on geology of industrial minerals, 2d, 1966, Proc.: Bloomington, Ind., Indiana Geol. Survey and Indiana Univ., p. 149–154, illus., tables [1966?].

The uses, advantages, and disadvantages of X ray emission and diffraction techniques in determining raw material suitability for cement manufacture are discussed. A cursory explanation of the operating principles of emission and diffraction X ray analysis is given. Reproducibility, precision, cost per analysis, and time per analysis are compared to the standard gravimetric methods of analysis. Three case histories of the use of X ray analysis in raw material exploration are cited.—Author's abstract

11216 **Boettcher, Arnold J.** Ground water development in the High Plains of Colorado: U.S. Geol. Survey Water-Supply Paper 1819-I, p. I1–I22, illus., tables, 1966.

The land surface of the High Plains of Colorado slopes eastward and in most places is gently rolling. The Pliocene Ogallala Formation, the principal aquifer, consists of semiconsolidated sand, gravel, silt, clay, and caliche, is overlain by dune sand, alluvium, or loess, and is recharged by precipitation at a rate of 0.85 inches per year. The major use of the water is for irrigation; water levels decline as much as ten feet during the irrigation season but return to normal afterwards. By prorating transmissibility on the basis of lithologic descriptions from well logs, the average permeability of the Ogallala Formation can be estimated. Most of the Ogallala water is a calcium bicarbonate solution and is generally hard.—LLP

02023 **Boggs, Sam, Jr.** A numerical method for sandstone classification: Jour. Sed. Petrology, v. 37, no. 2, p. 548–555, illus., 1967.

Sandstones may be classified according to a numerical scheme based on proportions of quartz, feldspar, and matrix. Advantages are that the system reflects only relative mineral abundance without regard to genesis and is adaptable to either field or laboratory use.—RAC

01948 **Bold, W. A. van den.** Ostracoda of the Gatún Formation, Panama: Micropaleontology, v. 13, no. 3, p. 306–318, illus., table, 1967.

Systematic descriptions of 36 species of ostracodes found in surface and subsurface samples of the Gatún Formation in the Canal Zone are given, and their distribution and stratigraphic ranges are discussed. Correlation of part of the Gatún Formation with the upper part of the Manzanilla Formation in Trinidad is suggested. It appears that the Gatún ostracode fauna is typical for the Neogene of the whole Caribbean region.—ESL

11184 **Bonamo, Patricia M.; Banks, Harlan P.** *Calamophyton* in the Middle Devonian of New York State: Am. Jour. Botany, v. 53, no. 8, p. 778–791, illus., table, 1966.

Specimens of *Calamophyton* from the Ashokan Sandstone near Kingston are shown to belong to *C. bicephalum* Leclercq and Andrews, a Belgian species. Steel needles and a stereoscopic binocular microscope were used to follow the path of the forking leaves and branching sporangiophores through the matrix. The terete leaves dichotomized two to three times in more than one plane; sporangiophores dichotomized once. Each branch, terminated in an elongate, filiform projection, bore three recurved lateral branches which in turn bore two sporangia, apparently dehiscing longitudinally. Their walls were composed of elongate cells, and the spherical spores ranged from 86–166 μ in diameter and bore a trilete mark. Ornamentation consisted of coni and spinae up to 4.5 μ long. This is the first account of *Calamophyton bicephalum* spores and the second report of the genus in North America.—*from* Authors' abstract

Borns, Harold W., Jr. *See* Swift, Donald J. P. 01941

Boucot, A. J. *See* Amsden, T. W. 02392

Boucot, A. J. *See* Johnson, J. G. 02394

02284 **Bowsher, Arthur L.** Ocean tides as a geologic process, *in* Essays in paleontology and stratigraphy—R. C. Moore Commemorative Volume: Kansas Univ. Dept. Geology Spec. Pub. 2, p. 319–348, illus., table, 1967.

Strong tidal currents resulting from long- and short-term tide cycles greatly influence the sediments that accumulate on most parts of the shallow neritic shelves, totaling over 10,000,000 sq mi in the existing oceans. The tidal process is a controlling factor in the shaping and distribution of these sediments, and in the physical, chemical, and biological environments through which they are transported, deposited, and lithified. Tidal and eustatic changes prevent shore zones from reaching equilibrium and aid the surf in its attack on the shore. Vast areas in the neritic zone are characterized by tidal current ridges, tidal scour channels, and shelf-margin shoals. Rotary and reciprocating tidal currents produce sediment bodies that differ significantly from those formed by wave-driven, longshore, and fluviate currents on which most of our sedimentation concepts are based.—*from* Author's summary

Boyd, F. R., Jr. *See* Appleman, D. E. 11130

01914 **Branson, Carl C.** Trace elements in Oklahoma coals [discussion of "Distribution of minor elements in some rocks in the western and southwestern regions of the Interior coal province," by P. Zubovic, N. B. Sheffey, and T. Stadnichenko, 1967]: Oklahoma Geology Notes, v. 27, no. 7, p. 150, 1967.

In analyses of coal ash by emission spectrography, 24 samples are from Pennsylvanian rocks of eastern Oklahoma. This author cannot concur with conclusions (U.S. Geol. Survey Bull. 1117-D, 1967) that drainage of the Pennsylvanian sea was southwestward and that solutions bearing minor elements were depleted southward. The "drainage directions" of the Desmoinesian sea are more probably current directions, and as for depletion of solutions, some of the elements move in the environment and become fixed to carbon molecules. They can be expected to be concentrated in permeable coal, adjacent to the tops and bottoms of thicker beds and in thin unworkable seams. Data are sparse, but the report points the way for further investigations which might lead to commercial deposits.—GDC

02132 **Branson, Carl C.; Wilson, L. R.** Fossils in McIntosh County, *in* Geology and petroleum of McIntosh County, Oklahoma: Oklahoma Geol. Survey Bull. 111, p. 41–43, 1967.

Occurrences of fossil invertebrates, plant megafossils and plant microfossils are discussed. Fossil invertebrates occur in limestones and shales of the Pennsylvanian Boggy Formation, in the Secor coal caprock, and in the Senora Formation, but no good collecting locality is known. Plant megafossils have been found in the Bluejacket and Taft Sandstones of the Boggy Formation and in the Stuart and Senora Formations. Localities are scattered and the fossils are fragmentary and poorly preserved. Studies of plant microfossils are restricted to two coal deposits of the Boggy Formation: a shale lens of the Bluejacket Sandstone, and the Secor coal.—LLP

Brisbin, W. C. *See* Haugh, I. 02167

02052 **Brookins, Douglas G.** Rb-Sr age evidence for Permian metamorphism of the Monson Gneiss, west central Massachusetts: Geochim. et Cosmochim. Acta, v. 31, no. 2, p. 281–283, illus., table, 1967.

Results of Rb-Sr determination on two whole rock samples, biotites separated from each sample, and feldspar separated from one of them indicate that the last strong thermal metamorphism which affected the Monson Gneiss in west central Massachusetts occurred in Permian time, 255 ± 10 m.y. ago.—DBV

02201 **Brown, Bahngrell W.** A Pliocene Tennessee River hypothesis for Mississippi: Southeastern Geology, v. 8, no. 2, p. 81–84, illus., 1967.

It is hypothesized that the discontinuous gravel defended ridges which extend southwestward from Scott County through Brookhaven are relict deposits from a Pliocene river course that may have been a southwestward extension of the Appalachian Tennessee River trend. Anomalous southeastward drainages in southern Mississippi are explained by this hypothesis.—Author's abstract

02381 **Brown, D. D.; Bennett, G.; George, P. T.** The source of alluvial kimberlite indicator minerals in the James Bay lowland: Ontario Dept. Mines Misc. Paper MP 7, 35 p., illus., tables, 1967.

Recent studies of alluvium in the Moose River drainage basin have revealed kimberlite indicator minerals, principally pyrope, with lesser magnesian ilmenite and one chrome diopside. Refractive index and unit cell parameters of the pyrope are similar to that from African and Siberian kimberlites. Identification of these alluvial indicators and a dike at Coral Rapids on the Abitibi River which is similar to kimberlite but apparently lacking in pyrope and chrome diopside, suggest kimberlite intrusions in the area. The Kapuskasing gravity anomaly, extending northeastward across the area, indicates upwarp and thinning of the granitic crust. On the east a parallel magnetic high corresponds to horst blocks of magnetic granulite. Regional complexes of alkalic rocks and carbonatite are associated with the Kapuskasing structure.—GDC

Brown, D. D. *See* Bennett, G. 02383

Brown, G. M. *See* Appleman, D. E. 11130

01917 **Brown, Harold A.** Structural control of Canadian River in western Oklahoma: Oklahoma Geology Notes, v. 27, no. 7, p. 135–149, illus., table, 1967.

Because of the low dip of near-surface strata, southeast less than 1°, surface geology in this area reveals little about the shallow subsurface structure. Here, the Canadian River meanders eastward with a gradient of 4 to 5 feet per mile on a slope of 15 to 20 feet per mile. Other streams, flowing southeastward, have less sinuous courses; the nearby Washita River gradient is about 15 feet per mile. The Canadian River course is older (Kansan) than others in this area; the river is more influenced by bedrock structure than by topography. Domelike structures mapped on the base of the Blaine anhydrite are not associated with anomalous drainage patterns of the

more youthful tributaries. The structure map presented shows the relationship to the Canadian River; cross sections show relations of stratigraphic units to topography.—GDC

Brown, William L., Jr. *See* Wilson, Edward O. 02195

Bruce, C. J. *See* Raasch, G. O. 11134

02365 **Bruins, G. J.** Professor Dr. Ir. F[elix] A[ndries] Vening Meinesz [d. 1966]: Allg. Vermessungs-Nachr., v. 74, no. 8, p. 310–312, portrait, 1967.

02049 **Brune, James N.; Allen, Clarence R.** A low-stress drop, low-magnitude earthquake with surface faulting—The Imperial, California, earthquake of March 4, 1966: Seismol. Soc. America Bull., v. 57, no. 3, p. 501–514, illus., table, 1967.

Up to 1.5 cm of right-lateral surface displacement occurred over a 10-km section of the Imperial fault as a result of an earthquake of M = 3.6, the smallest known earthquake yet associated with surface displacement. The association of the displacement with this earthquake is supported by the shallow focal depth, high excitation of Love waves of 8- to 15-sec period, the distribution of aftershocks, and the agreement of source movement calculated from observed faulting and from Love wave amplitudes. A fault depth of 1.1 km, net moment of 2×10^{25} dyne-cm, stress drop of 1.1 bar, and energy release of 10^{17} ergs are calculated.—DBV

Bryson, Reid A. *See* Bender, Margaret M. 02227

02316 **Bugry, Raymond.** Geochemistry of boron in pelitic sediments [abs.]: Bull. Canadian Petroleum Geology, v. 15, no. 2, p. 213, 1967.

02063 **Burridge, R.; Knopoff, Leon.** Model and theoretical seismicity: Seismol. Soc. America Bull., v. 57, no. 3, p. 341–371, illus., tables, 1967.

A laboratory and a numerical model have been constructed to explore the role of friction along a fault as a factor in the earthquake mechanism. The laboratory model demonstrates that small shocks are necessary to the loading of potential energy into the focal structure; a large part, but not all, of the stored potential energy is later released in a major shock, at the end of a period of loading energy into the system. By the introduction of viscosity into the numerical model, aftershocks take place following a major shock. Both models have features which describe the statistics of shocks in the main sequence, the statistics of aftershocks and the energy-magnitude scale, among others.—Authors' abstract

Bustillo Saynez, Gonzalo. *See* delCampo H., Roberto Martin. 11120

Byrne, John V. *See* Kulm, L. D. 02153

01983 **Cameron, E. M.** A computer program for factor analysis of geochemical and other data: Canada Geol. Survey Paper 67-34, 41 p., illus., tables, 1967.

A program, written in Fortran II for a CDC 3200 computer with a 16K memory, is given for the factor analysis of data containing up to 36 variables. Principal components are extracted by the Jacobi method and up to 26 factors are rotated first to orthogonal simple structure using the Varimax criterion and then to oblique simple structure by the Promax method. Factor scores are computed by Harmon's (1960) method of ideal variables. A separate program computes scores from either orthogonal or oblique factor matrices by a method of Kaiser's (1962).—Author's abstract

02302 **Campbell, Douglas D.** Discussion [of] "Portage Mountain dam"—[Pt.] 1, by C. F. Ripley, and [Pt.] 2, by G. C. Morgan and M. C. Harris, 1967, *in* Canadian Soil Mechanics Conf., 19th, 1966, [Pt.] 2: Canadian Geotech. Jour., v. 4, no. 2, p. 172–175, 1967.

As a geologic consultant, the author was involved in the Peace River, British Columbia, project since its inception in 1957. He provides details to some of the

subjects outlined by Ripley (ibid., p. 125–141) regarding the choice of site, powerhouse, and dam design. Comments made on the second part (Morgan and Harris, ibid., p. 142–166) include the fact that the moraine was deposited in a lake rather than deposited by "fluvial" processes and that it did not slump on the glacier side.—ESL

Campbell, Joel B. *See* Nelson, J. H. 11160

11190 **Campbell, R. B.; Dodd, J. S.** Estimated rock stresses at Morrow Point underground powerplant from earthquakes and underground nuclear blasts, Rept. SA-6: Denver, Colo., U.S. Bur. Reclamation, 53 p., illus., tables, 1966.

Seismic rock stresses, resulting from synthetic and actual earthquakes, underground nuclear explosions, and penstock excavation blasting, were calculated for Morrow Point underground powerplant, Colorado. Using elastic vibration theory, underground rock stresses were computed from derived maximum ground particle velocities. A correlation was developed relating earthquake intensity and size of underground nuclear blast. Rock stresses computed from the design earthquake and a comparable underground nuclear explosion were in good agreement. A comparison of these stresses with known rock strengths along with a review of the possible failure mechanism indicated that the stability of the opening is at least as great for the dynamic condition as for the static condition. Maximum stresses induced by penstock excavation blasting were less than those computed for the design earthquake.—*from* Authors' abstract

02414 **Canada Geological Survey.** Aeromagnetic map, Sheet 27 C/14, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4777, scale 1:63,360, 1967.

02415 **Canada Geological Survey.** Aeromagnetic map, Sheet 27 C/11, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4778, scale 1:63,360, 1967.

02416 **Canada Geological Survey.** Aeromagnetic map, McBeth River, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4779, scale 1:63,360, 1967.

02417 **Canada Geological Survey.** Aeromagnetic map, Sheet 27 C/3, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4780, scale 1:63,360, 1967.

02238 **Canadian Mining and Metall. Bull.** Underground operations at Texada: Canadian Mining and Metall. Bull., v. 60, no. 663, p. 815–818, 1967.

Lenses of magnetite are in skarn zones at the contact between Late Triassic limestone and diorite or basalt. The magnetite ore contains some chalcopyrite, marcasite, and pyrrhotite.—ARK

02241 **Canadian Mining and Metall. Bull.** Operations of Red Mountain Mines, Ltd.: Canadian Mining and Metall. Bull., v. 60, no. 663, p. 807–808, 1967.

Volcanic and sedimentary rocks of the Mount Roberts and Rossland Formations are intruded by felsic to mafic rocks and silicified and brecciated. Host rock for the ore is mainly andesite, tuff, and agglomerate. Molybdenite is the only ore mineral, but pyrite, pyrrhotite and chalcopyrite are common. Molybdenite is in a brecciated and silicified zone and much of it is very fine grained.—ARK

02357 **Canut-Amorós, Marisa.** On the significance of two new Patterson functions for disordered crystals: Zeitschr. Kristallographie, v. 124, nos. 4–5, p. 241–261, illus., 1967.

On account of the Fourier transformation reciprocity theorem it is possible to go back and forth from physical space to reciprocal space. One mechanism involves Fourier summations of sampled values in one space, leading to a continuous, periodic function in the other. Two new Patterson functions are defined, one for

a thermally agitated crystal, and another for a disordered crystal. These new functions yield to two new Fourier mates. The new difference Patterson functions allow one to calculate the continuous diffuse scattering functions arising from thermal and positional disorder, respectively, without any previous knowledge of the crystal structure. The quasi periodic Q functions of the thermally agitated or disordered molecular crystals are analyzed in terms of only two motifs calculated in terms of adequate Patterson functions. *from* Author's abstract

02206 **Carlson, Kendall P.** South Keg Coulee field, Musselshell County, Montana: Mtn. Geologist, v. 4, no. 3, p. 91–94, illus., 1967.

The South Keg Coulee oil field, located in Musselshell County in central Montana, was discovered in January of 1964. Production was found in the basal sandstone ("C" Sand) of the lower Tyler Formation (Mississippian) at a depth of 4,725 feet. Nine additional producing wells have been drilled to date. The field is a stratigraphic trap on a south dipping structural nose; the reservoir was formed by deposition of sandstone in a river channel. Structure is important only in establishing the position of the oil water contact at the south end of the field. Cumulative oil production through 1966 is more than 450,000 bbl and the ultimate yield from both primary and secondary oil is expected to be more than 2,000,000 bbl.—Author's abstract

11127 **Carolina Geological Society; LeGrand, Harry E.; Bell, Henry, 3d.** (leaders). Guidebook of excursion in Cabarrus County, North Carolina, October 22–23, 1966: [Durham, N. C., Duke Univ.] 39 p., illus., table, 1966.

The purpose of this guidebook was to provide a brief geologic background for a field trip in the vicinity of Concord, Cabarrus County. Subjects observed or discussed include: (1) geologic rock types and structures, (2) syenite ring dike—its structural features and its weathering behavior, (3) a widespread granite–diorite complex, (4) results of geochemical reconnaissance for ore deposits, (5) subsurface profiles of the weathered zone, of the water table, and of the water bearing fracture zone, and (6) geomorphology.—LLP

Carpenter, Frank M. *See* Wilson, Edward O. 02195

Carroll, Robert L. *See* Baird, Donald. 02175

Chaigneau, Marcel. *See* Girault, Jean. 01938

02148 **Chanda, S. K.** Selective neomorphism and fabric discontinuities in limestones: Jour. Sed. Petrology, v. 37, no. 2, p. 688–690, illus., 1967.

In microcrystalline allochemical limestones and biolithites, sharp fabric discontinuities or boundaries may be anticipated as a result of an aggrading neomorphism. Such discontinuities are commonly caused by structural discontinuities in the initial fabric, that is, boundaries between either skeletal components or terrigenous grains and nonskeletal microcrystalline matrix. This important but much neglected feature deserves more attention because many carbonate petrographers interpret sharp boundaries of areas of sparry calcite as diagnostic of void-filling rather than neomorphic calcite. Physico-chemical conditions in packed microcrystalline limestones appear to favor porphyroid neomorphism.—Author's abstract

Cherry, J. A. *See* Clayton, Lee. 02011

Chilingar, G. V. *See* Wolf, K. H. 02100

02099 **Chilingar, George V.; Bissell, Harold J.; Fairbridge, Rhodes W.** (editors). Developments in sedimentology—[V.] 9B, Carbonate rocks—Physical and chemical aspects: Amsterdam and New York, Elsevier Publishing Co., 413 p., illus., tables, 1967.

This is a compilation of nine papers dealing with data, ideas, and concepts of physical and chemical aspects of carbonate rocks. Although both high- and low-

temperature carbonate types are recognized, the papers are concerned primarily with the low-temperature type. Subjects discussed are: composition, formation, isotope distribution, pressure-temperature influences, petroleum in carbonates, techniques of analysis, and properties and uses of carbonates. Papers by K. H. Wolf, W. H. Taft, K. J. Hsu, E. T. Degens, J. M. Hunt, and F. R. Siegel are cited separately.—LLP

Chilingarian, George V. *See* Serruya, Collette. 02150

Chilman, Ruth B. *See* Stumm, Erwin C. 02249

Christiansen, Robert L. *See* Barnes, Harley. 02031

01984 **Christie, R. L.** Stratigraphic sections of Palaeozoic rocks on Prince of Wales and Somerset Islands, District of Franklin, Northwest Territories: Canada Geol. Survey Paper 67-24, 21 p., illus., 1967.

The results of measurement of six stratigraphic sections in lower and middle Paleozoic rocks in the central Canadian Arctic are presented with a brief discussion of the age and correlation of the strata. The Prince of Wales-Somerset region straddles the northern part of Boothia uplift, which includes a finger extension of the Canadian Shield; one section is from its western margin where vertical Paleozoic beds lie directly against the uplifted crystalline rocks. Strata on the eastern flank are upturned some miles east of the Precambrian area. The five sections of the eastern flank were measured across gently tilted beds rather than in the fold zones.—GDC

11124 **Chugayeva, M. N.** Sravneniye trilobitovykh kompleksov nizhnego ordovika Severo-Vostoka SSSR, Sibiri i Severnoy Ameriki: Akad. Nauk SSSR Doklady, v. 167, no. 3, p. 648-651, table, 1966; English translation, Acad. Sci. USSR Doklady, Earth Sci. Sec., v. 167, nos. 1-6, p. 34-37, table, 1966.

The names American-Siberian, Baltic and Sino-European regions are proposed for the Bathyurid, Asaphid and Calymenid-Trinucleid biogeographic provinces established by [H. B.] Whittington [1963] for the Ordovician. Based on trilobite assemblages, Siberia and northeastern USSR belonged to the American-Siberian biogeographic region that included North America, northern Scotland, northwestern Norway, Greenland, Siberia and the northeastern USSR in the Early Ordovician.—AGI Staff

11139 **Churkin, Michael, Jr.** Lower Paleozoic rocks of Alaska [abs.], *in* Lower Paleozoic symposium: Bull. Canadian Petroleum Geology, v. 14, no. 4, p. 603, 1966.

Clark, David L. *See* Müller, Klaus J. 02397

Clay, C. S. *See* Rona, Peter A. 01908

02011 **Clayton, Lee; Cherry, J. A.** Pleistocene superglacial and ice-walled lakes of west-central North America, *in* Glacial geology of the Missouri Coteau—Midwest Friends of the Pleistocene, Field Conf. 1967, Guidebook: North Dakota Geol. Survey Misc. Ser. 30, p. 47-52, illus., 1967.

Superglacial and ice-walled lakes were characteristic of late Wisconsin stagnant glaciers in central North America and are commonly found on present-day stagnant glaciers. The hilly collapsed sediments of superglacial lakes and perched plains of ice-walled lakes are today two of the most characteristic features of areas of former stagnant glaciers.—Authors' summary

Cleveland, John H. *See* Vitaliano, Charles J. 11208

02336 **Coats, K. H.; Richardson, J. G.** Calculation of water displacement by gas in development of aquifer storage: Soc. Petroleum Engineers Jour., v. 7, no. 2, p. 105-112, illus., tables, 1967.

During the initial growth of a gas bubble in an aquifer storage reservoir, the injected gas tends to override the water. The resulting low displacement of efficiency and high rate of gas travel down-structure make it difficult to maintain water-free production. This paper illustrates the use of two-dimensional, two-phase calculations to simulate this gas-water displacement. Calculations were performed for a stratified aquifer and for several homogeneous sands differing in permeability, porosity and thickness. Results are discussed and compared with performance predictions obtained from the simpler Buckley-Leverett and Dietz formulas. This comparison indicates the necessity for the two-dimensional calculations in realistically simulating the gravity override of the water by injected gas.—Authors' abstract

11118 **Coats, Keith H.** Some technical and economic aspects of underground gas storage, *in* Natural gas—Inst. Petroleum, Explor. and Production Group, Symposium, London, 1966, Proc.: London, Elsevier Publishing Co., p. 73-90, illus., tables, discussion, 1966.

Aquifers and depleted fields offer large, low-cost storage capacity for natural gas; use of aquifers is a relatively recent development in areas where depleted fields are unavailable. Technology has yet to eliminate the problems of gas leakage which have arisen in a majority of the U.S. aquifer storage projects. Water movement, causing a varying reservoir pore volume, complicates prediction of pressure, and hence deliverability, from gas withdrawal schedules. Permeability and dip angle of an aquifer structure affect the creation of a thick bubble allowing sustained gas withdrawal. The investment is considerably greater in aquifers than in depleted fields because the latter come equipped with wells, surface facilities, and some cushion gas; aquifer storage demands considerable exploratory work to prove its structural suitability.—GDC

02234 **Cobb, Edward H.; Kennedy, Della L.** Geologic map index of Alaska, 5th edition: Washington, D.C., U.S. Geol. Survey, scale 1:2,500,000, separate text, 1967.

The text lists reports and maps prepared by the Geological Survey relating to the geology and mineral and water resources of Alaska; it includes open-file reports also. Libraries and depositories where publications may be obtained are listed.—M.C.M.

Coggeshall, N. D. *See* Zarrella, W. M. 02039

Colburn, Ivan P. *See* Hampton, Monty A. 02020

01946 **Cole, W. Storrs.** A review of American species of miogypsinids (larger Foraminifera): Cushman Found. Foram. Research Contr., v. 18, pt. 3, p. 99-117, illus., tables, 1967.

Twenty-one specific names have been proposed for American miogypsinids since Cushman in 1918 described the first species, *Heterosteginoides panamensis*. Several authors have analyzed these species and proposed different classifications. This article expands the postulate (Cole, 1964) that recognition of only three species is sufficient to account for the biological development as well as the geographic and stratigraphic distribution of American miogypsinids, particularly in the Gulf Coastal Plain and Caribbean localities. The status of subgenera considered as synonyms of Miogypsina s.s. is discussed.—GDC

02199 **Colquhoun, Donald J.** General relationships between soils and environments on the southern Atlantic Coastal Plain—A reply [to discussion by R. B. Daniels, *et al*, 1967 of "Geomorphology of river valleys in the southeastern Atlantic Coastal Plain", 1966]: Southeastern Geology, v. 8, no. 2, p. 97-104, illus., 1967.

Soil maps used in conjunction with airphotos and topographic maps have proven to be a valuable tool in extension of known subsurface and surface data (Daniels, *et al*, ibid., p. 89-96), but they must be evaluated constantly when making correlations. Primary geomorphic surfaces are underlain by generally similar types of soils, lithologies, and structures. This is more apparent in the Lower Coastal Plain than in the Middle and Upper. The internal characteristics of soils reflect

original depositional environment and are also a product of post-depositional. They may provide a record of post-depositional exposure which could be missing in the area (original paper, ibid., v. 7, p. 101–109, 1966).—ESL

Conkin, Barbara M. *See* Conkin, James E. 02298

02298 **Conkin, James E.; Conkin, Barbara M.** Arenaceous Foraminifera as a key to Upper Devonian–Lower Mississippian relationships in the type Mississippian, *in* Essays in paleontology and stratigraphy—R. C. Moore Commemorative Volume: Kansas Univ. Dept. Geology Spec. Pub. 2, p. 85–101, illus., 1967.

Stratigraphic distribution of 35 important species of arenaceous Foraminifera in the type Mississippian area of Missouri and Illinois is as follows: four species restricted to Upper Devonian; four in Upper Devonian and Kinderhookian; four from Upper Devonian through Osagean; 15 restricted to Kinderhookian; seven in Kinderhookian and lower Osagean; one restricted to Osagean. History of stratigraphic nomenclature of the Kinderhookian Series and Chouteau Group of Missouri is reviewed. Stratigraphic significance of the *Hyperammina rockfordensis–H. kentuckyensis* phylogenetic lineage is discussed; these species are respectively, a characteristic Kinderhookian and a definitive Osagean marker in the type Mississippian area. Most of the above species can be used also for interregional correlation in the United States.—VMJ

01924 **Connally, G. Gordon; Sirkin, Leslie A.** The Pleistocene geology of the Wallkill Valley, *in* New York State Geol. Assoc., Guide book to field trips, 39th Ann. Mtg., New Paltz, N. Y., 1967: New York, City Coll. City Univ. New York, Dept. Geology, p. A1–A21, G1–G3, illus., table, 1967.

The Wallkill Valley, a northeast–southwest trending basin of the Valley and Ridge Province, extends from New York State into northern New Jersey. The Ordovician Martinsburg Formation underlying the valley consists of greywackes, shales, and sandstone in the east and farther west is overlain by the Shawangunk conglomerate. There are also outcrops of Precambrian and Cambrian rocks and Devonian clastics. The topography is characterized by hogbacks, roches moutonnées, drumlins, thick glacial drift, and a deranged drainage pattern. The valley's Pleistocene history began with a Wisconsin glacier that probably advanced in two lobes to the Ogdensburg–Culvers Gap moraine. As the glacier retreated, four lake stages developed. Pollen stratigraphy and radiocarbon dating indicate the recession began prior to 15,000 years B.P., suggesting it is correlative with the Tazewell Substage of the midwest.—LLP

Cook, D. R. *See* Jerome, S. E. 01913

Cordani, U. G. *See* Hurley, P. M. 02043

Craft, T. F. *See* Eichholz, G. G. 02053

02300 **Craig, James; Devine, Jack; McGill, Peter; Meneley, Robert.** Chinchaga and Keg River Formations of Slave River area, northern Alberta: Bull. Canadian Petroleum Geology, v. 15, no. 2, p. 125–137, illus., 1967.

In the Slave River–Little Buffalo area south of Great Slave Lake, Northwest Territories, the Keg River and Chinchaga Formations thin from west to east due to truncation by post-Devonian erosion and onlap on paleotopographic, Precambrian highs.—Authors' abstract

Crawford, Paul B. *See* Huskey, William L. 02355

02139 **Creer, K. M.** Application of rock magnetism to investigations of the secular variation during geological time, *in* Magnetism and the cosmos—NATO Advanced Study Inst. Planetary and Stellar Magnetism, Univ. Newcastle upon Tyne, 1965: New York, American Elsevier Publishing Co., p. 45–59, illus., tables, 1967.

The most promising means of investigating the complete pattern of secular variations of the geomagnetic field is by paleomagnetic studies. This pattern must include

shifts in the direction of the geomagnetic axis so that when averaged over long enough times (10^4–10^5 years) the mean direction coincides with the geographic axis. One approach is that of studying the dispersion of a large number of ancient field directions by determining the directions of remanent magnetization. Mean directions computed from large numbers of Quaternary flows coincide with the axial dipole field at the site; dispersion of individual flow directions about the mean gives information about the ancient secular variation. Methods of determination of dispersion produced by the ancient secular variation, regional variation in scatter, and regional paleosecular variation studies are summarized.—VSN

11211 **Cridland, Arthur A.** *Biscalitheca kansana* sp. n. (Coenopteridales, Zygopteridaceae), a compression from the Lawrence Shale (Upper Pennsylvanian), Kansas, U.S.A.: Am. Jour. Botany, v. 53, no. 10, p. 987–994, illus., 1966.

The organ bearing the sporangia of *Biscalitheca kansana* is a laminate rachis with subopposite fertile appendages, a structure previously unknown for *Biscalitheca*. The sporangia differ from those of the petrified *Biscalitheca musata* only by lacking nests of sclerotic cells. They contain spores which are called *Convolutispora* when found dispersed. Speculations are made that *Monoscalitheca fasciculata* will ultimately be regarded as a synonym of *Biscalitheca musata* and that some fossils called *Aphlebia and Brittsia problematica* may be the sterile foliage of zygopterids.—Author's abstract

Cummins, Herman Z. *See* Shapiro, Stephen M. 02253

02077 **Curl, Rane L.** Minimum diameter stalagmites [abs.]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 97, 1967.

02089 **Cushman, R. V.** The shape, slope, and fluctuations of the basal water table in the Mammoth Cave area, Ky. [abs.]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 107, 1967.

Dachille, F. *See* Simons, P. Y. 02408

Damon, Paul E. *See* Haynes, C. Vance, Jr. 02211

02015 **d'Anglejan, B. F.** Origin of marine phosphorites off Baja California, Mexico: Marine Geology, v. 5, no. 1, p. 15–44, illus., tables, 1967.

Investigation of bedded phosphorite within recent continental shelf sediments off the west coast of Baja California, lat 24° to 26° N., indicates local conditions conforming with those for large-scale phosphate deposition inferred from ancient marine phosphorites. The mass of the deposit is estimated at $1.5 \cdot 3 \times 10^9$ tons P_2O_5, with at least 0.5–1 m.y. required for accumulation and with present distribution considerably influenced by profound mixing during transgressive-regressive cycles in that time; evidence indicates that an in situ as well as detrital origin must be considered. Carbon 14 and U 238/Th 230 determinations gave ages from 10,000 to 27,000 years and 2×10^5 yr respectively; the applicability of the latter dating method, however, is not certain.—VSN

02198 **Daniels, R. B.; Gamble, E. E.; Steele, F.** Geomorphology of river valleys in the southeastern Atlantic Coastal Plain—A discussion [of paper by D. J. Colquhoun, 1966]: Southeastern Geology, v. 8, no. 2, p. 89–96, illus., 1967.

Colquhoun (ibid., v. 7, p. 101–109, 1966) stated that similar landforms are found to be underlain by similar soils and lithologies, so that where environments are known, they can be extended by use of soil maps. The authors point out some of the dangers in using soils for this kind of correlation. The variation in cause and effect relations between depositional environments and soils is explained by outlining how soils are mapped, criteria used, and current concepts of classification.—ESL

Daugherty, Kenneth I. *See* Rice, Donald A. 11161

02003 **Davies, Fred A.; Davies, Herman F.** Stephen Howell Gester (1889–1967): Am. Assoc. Petroleum Geologists Bull., v. 51, no. 7, p. 1371–1372, portrait, 1967.

Davies, Herman F. *See* Davies, Fred A. 02003

Davis, E. Mott. *See* Valastro, S., Jr. 02224

01992 **Davis, John C.** Application of response surface analysis to sedimentary petrology, *in* Computer applications in the earth sciences—Colloquium on trend analysis: Kansas Geol. Survey Computer Contr. 12, p. 57–62, illus., table, 1967.

A common practice for handling sample information from measured sections is to compute average values for each section. Vertical variation, which may be more significant than lateral, is completely lost. In many cases, three dimensional polynomial response surfaces are effective for producing summary representations of spatially distributed data. They have been applied to studies of igneous plutons, and to hydrocarbon distributions, but not to other sedimentary problems. Polynomial response surfaces are power function regressions in which independent variables are geographic coordinates; the response surface may be expressed as a contour map or a block diagram, according to the variables. Polynomial response surfaces were used to analyze mineral distribution in the Mowry Shale, Wyo. Isopleth block diagrams and slice maps are included.—ESL

02283 **Dawson, Mary R.** Lagomorph history and the stratigraphic record, *in* Essays in paleontology and stratigraphy—R. C. Moore Commemorative Volume: Kansas Univ. Dept. Geology Spec. Pub. 2, p. 287–316, illus., 1967.

Origin of the mammalian order Lagomorpha is obscure; *Eurymylus*, the oldest genus, occurs in late Paleocene of Asia. By late Eocene primitive forms ancestral to the Leporidae and Ochotonidae inhabited Asia and North America. Leporids progressed gradually through the Cenozoic, not having much diversity until the late Pliocene. All Recent leporid genera can be traced to a complex of late Pliocene and Pleistocene leporines. Ochotonids reached their greatest diversity and geographic distribution in the Miocene, but thereafter became much reduced in variety and distribution. A relatively unchanging morphology of parts usually fossilized limits the use of lagomorphs for stratigraphic correlation. Leporids are most useful for correlation in late Pliocene and early Pleistocene of North America and Eurasia, and ochotonids are most useful in the Miocene of Europe.—*from* Author's abstract

de Almeida, F. F. M. *See* Hurley, P. M. 02043

Decker, B. Louis. *See* Rice, Donald A. 11161

02180 **Degens, Egon T.** Stable isotope distribution in carbonates, Chap. 5 *in* Developments in sedimentology—[V.] 9B, Carbonate rocks—Physical and chemical aspects: Amsterdam and New York, Elsevier Publishing Co., p. 193–208, illus., 1967.

A brief survey has been presented on the stable isotope geochemistry of carbonates. Emphasis was placed on sedimentary carbonates in view of the fact that most of the other chapters of this book are almost exclusively concerned with sediments. The principal goal of this chapter was to demonstrate in what way stable isotope studies may contribute to a better understanding of certain problems in the area of classical geology and petrography; the data were selected accordingly.—Author's abstract

02341 **Delany, A. C.; Delany, Audrey Claire; Parkin, D. W.; Griffin, J. J.; Goldberg, E. D.; Reimann, B. E. F.** Airborne dust collected at Barbados: Geochim. et Cosmochim. Acta, v. 31, no. 5, p. 885–909, illus., tables, 1967.

Wind-borne dust collections have been made on Barbados, and day to day amounts have been recorded for several months beginning August 1965. The dust is probably derived from Europe and Africa. Its contribution to the deep-sea sedimentation of the western tropical Atlantic is estimated to be about 0.6 mm per 1,000 yr.

suggesting that a goodly fraction of the deep-sea clay is indeed wind transported. A dolomite gradient across the ocean is established. Fresh water diatoms occur in all the Barbados dusts; the occasional presence of *Denticula elegans* suggests that some of the dust comes from a mountainous region.—DBV

Delany, Audrey Claire. *See* Delany, A. C. 02341

11120 **delCampo H., Roberto Martin; Bustillo Saynez, Gonzalo.** Estudio de arcilla con alto contenido de alumina en el municipio de Guadalcázar, S.L.P.: Geología y Metalurgía, v. 3, no. 18, p. 35–64, illus., tables, 1966.

Eight new high-alumina clay deposits were examined, in addition to the El Cuervo deposit, on which work was already under way. All the deposits occur in solution cavities along fractures in Cretaceous limestones which are overlain by Tertiary and Quaternary granite and volcanic rocks. All probably had a similar origin from volcanic tuffs, clays derived from leaching of the limestones, and sediments from decomposition of igneous rocks and soils, which formed a clayey mixture enriched in aluminum by thermal solutions. All samples are predominantly alunite and kaolinite. The three largest deposits, El Cuervo, Cuesta Chiquita, and La Estacada, contain probable reserves of 603,890 metric tons; considering the variable alumina content shown in chemical analyses, the total tonnage is insufficient to warrant development of the aluminum industry in Mexico at this time.—VMJ

02323 **Delorme, Denis Larry.** Pleistocene and post-Pleistocene ostracods of Saskatchewan [abs.]: Bull. Canadian Petroleum Geology, v. 15, no. 2, p. 216–217, 1967.

11175 **Dempsey, Michael.** The round world—Foundations of geology and geomorphology: Boston, Mass., Ginn and Co. (Foundations of Science Library—The natural world, published by Sampson Low, Marston and Co., London), 128 p., illus., 1966.

Four of the chapters of this volume, under the heading *Nature of the Earth*, discuss structure of the Earth, drilling through the crust, reading the rocks, and the work of the geologist; five, under *Skin of the Earth*, describe types of rocks, folds and faults, and soils; four, under *Restless Earth*, deal with volcanic eruptions, earthquakes, mountain making, and continental drift; seven, under *Shaping the land*, stress the power of agents of weathering, erosion, and cave formation; and seven, under *Wealth of the Earth*, discuss fossil fuels, geothermal energy, sources of metals, mineral identification and commercial value.—GDC

11189 **Dempsey, Michael; Larkin, David.** The ages of the Earth—Foundations of palaeogeography and palaeontology: Boston, Mass., Ginn and Co. (Foundations of Science Library—The natural world, published by Sampson Low, Marston and Co., London), 128 p., illus., 1966.

The chapters of this volume are grouped under the following subject headings: the key to the past; the pageant of life; the Palaeozoic world; the Mesozoic world; and the Cenozoic world. Numerous examples are presented from North America, as well as from the British Isles and other regions of the world.—GDC

11182 **Denison, Robert H.** *Cardipeltis*, an Early Devonian agnathan of the order Heterostraci: Fieldiana—Geology, v. 16, no. 4, p. 89–116, illus., 1966.

New material of *Cardipeltis* including articulated specimens from the Early Devonian Beartooth Butte formation of the Bighorn Mountains east of Lovell, Wyo., is referred to two new species, *C. richardsoni and C. bryanti*. The dorsal shield consists of a large, notched dorsal disc, a series of paired marginal plates, and a rostral region. The ventral shield consists of isolated tesserae and two or more large postoral plates. The mouth was probably nearly terminal, the tail was narrow and flat-based anteriorly, the canal system was ventrally reduced, and the exo-skeleton was thick with a rather thick spongiosa. *Cardipeltis*, a bottom dweller in streams and perhaps in sea margins, was probably derived from primitive Heterostraci with a shield of isolated tesserae, and is best retained in a family of its own, the Cardipeltidae.—*from* Author's summary

Desborough, George A. *See* Baxter, James W. 02125

Dever, Garland R., Jr. *See* McGrain, Preston. 11201

Devine, Jack. *See* Craig, James. 02300

01974 **Dickinson, William R.; Hatherton, Trevor.** Andesitic volcanism and seismicity around the Pacific: Science, v. 157, no. 3790, p. 801–803, illus., table, 1967.

Circum-Pacific andesites, with associated basalts and dacites, are erupted from linear island arcs and marginal continental ranges whose ocean-side borders coincide approximately with the continent-side boundaries of belts of shallow seismicity that parallel adjacent trenches. The lines of active volcanoes stand above elongate subcrustal regions delineated by the intersection of inclined Benioff seismic zones and the subhorizontal Gutenberg low-velocity zone. Close correlation between content of potash erupted lavas and vertical depth to the Benioff zone suggests that andesitic volcanism has its origins in the mantle where magmas are generated by events associated with earthquakes of intermediate focal depth.—Authors' abstract

01978 **Dillon, E. L.** Expanding role of computer in geology: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 7, p. 1185–1201, illus., 1967.

Cooperative well data systems now cover most of the United States and parts of Canada; about one billion characters of basic information were released to subscribers in 1966, and this volume should double in 1967. Companies are presently setting up peripheral files for restricted or detailed information. The Committee on Statistics of Drilling (CSD) of the AAPG administers a new well statistics system primarily for providing information required by State and Federal regulatory bodies. Examples of trend-surface analysis and residual mapping illustrate how analytical techniques are directly related to geologic work.—BHK

Dirom, G. E. *See* White, William H. 02169

Dodd, J. S. *See* Campbell, R. B. 11190

02344 **Dodd, R. T., Jr.; VanSchmus, W. R.; Koffman, D. M.** A survey of the unequilibrated ordinary chondrites: Geochim. et Cosmochim. Acta, v. 31, no. 6, p. 921–951, illus., tables, 1967.

The iron contents of olivines and low-Ca pyroxenes in 31 ordinary chondrites were determined by microprobe analysis; 25 contain inhomogeneous silicates and are in this respect unequilibrated. Those whose silicates are most heterogeneous are nearly unmetamorphosed. A complete gradation of properties exists between these and the equilibrated ordinary chondrites. Different contents of the siderophile elements appear to have been established during or before agglomeration of the parent materials. Siderophile fractionation among the groups may have resulted from mechanical mixture of a silicate fraction with different proportions of metal-rich material.—DBV

02255 **Dodd, Robert T.; Teleky, Lorraine S.** Preferred orientation of olivine crystals in porphyritic chondrules: Icarus, v. 6, no. 3, p. 407–416, illus., 1967.

Ten chondrules from the Hallingeberg and Krymka chondrites, with 50 to 150 olivine crystals each, have been examined. Crystals larger than about 0.1 mm show a distinct preferred orientation of the longest axes indicative of a planar orientation and a linear alinement in the plane of foliation; the small crystals in each chondrule show a weak preferred orientation or none. The olivine fabrics resemble mineral fabrics found in the Moore County eucrite and in terrestrial basic intrusive rocks; they suggest a line of evidence favoring an extrusive origin for chondrites.—JHF

02360 **Donn, William; Shaw, David M.; Emiliani, Cesare.** Isotopic paleotemperatures—Discussion [of paper by C. Emiliani, 1966; and reply]: Science, v. 157, no. 3789, p. 722–725, illus., 1967.

Donn and Shaw analyze Emiliani's (ibid., v. 154, no. 3751, p. 851–857, 1966; Jour. Geology, v. 74, no. 2, p. 109–126, 1966) data and analytical methods and find that his climatic curve is inaccurate and his correlation of core stages with radiation variations untenable. They claim that data on core stage thickness are still too few and the procedures too subjective to be of significance in establishing a causal relationship between glacial interglacial climate change and Milankovich cycles of insolation variation. Emiliani attempts to show that this criticism rests on wholly uncritical evaluation of the original analytical data and on questionable statistical arguments.—DBV

11136 **Dooge, J.; Raasch, G. O.** Lithologic and faunal aspects of the Lower Paleozoic at Royal Creek, Yukon Territory [abs.], *in* Lower Paleozoic symposium: Bull. Canadian Petroleum Geology, v. 14, no. 4, p. 601, 1966.

11171 **Dorheim, Fred H.** Gypsum resources of Iowa, *in* Symposium on geology of cement raw materials—Forum on geology of industrial minerals, 2d, 1966, Proc.: Bloomington, Ind., Indiana Geol. Survey and Indiana Univ., p. 73–82, illus. [1966?].

Because Iowa is an important source of gypsum for cement and because the Fort Dodge gypsum will be depleted within 70 years, future resources are considered. Areas of evaporite deposition in the state are shown on maps. Well logs show evaporites in the Mississippian, with economic occurrences in the St. Louis–Warsaw. Gypsum occurs at the boundary of the evaporite body and adjacent beds and anhydrite, within the evaporite body. Devonian evaporites are shown by 171 wells and appear to occur over a larger area than the younger ones. Local structure and hydrodynamic fluid movement may control the location of evaporite deposition.—ESL

11137 **Douglas, R. J. W.** Late Proterozoic and early Paleozoic geosynclines and cratons in Canada [abs.], *in* Lower Paleozoic symposium: Bull. Canadian Petroleum Geology, v. 14, no. 4, p. 602, 1966.

01982 **Dow, Wallace G.** The Spearfish Formation in the Williston basin of western North Dakota: North Dakota Geol. Survey Bull. 52, 28 p., illus., 1967.

The Spearfish Formation of the Black Hills has been traced into the subsurface of the Williston basin from bore holes at the northern margin of the outcrop area in eastern Wyoming. In the basin, the three lithological units of the Spearfish are: a lower gray shale and red siltstone unit, herein named the Belfield Member; a middle salt unit, the Pine Salt Member; and an upper red siltstone unit, the Saude Member. The lower two units are considered to be Permian and are correlated with rocks in the Black Hills, while the Saude is predominantly Triassic. A persistent anhydrite and salt bed in the lower part of the Saude is correlated with the top of the Goose Egg Formation in eastern Wyoming. A major unconformity is developed on top of the Saude south of Cedar Creek anticline, but evidence in North Dakota is generally lacking.—*from* Author's abstract

02265 **Dragovich, Deirdre.** Flaking, a weathering process operating on cavernous rock surfaces: Geol. Soc. America Bull., v. 78, no. 6, p. 801–804, illus., 1967.

Fluctuations in temperature within the caverns and differences in air humidity between inside and outside are too small to account for rock disintegration by flaking. Flakes are 1 to 15 mm in size and do not follow grain boundaries or apparent structural weaknesses. Expansion by slow hydration and alteration is the probable cause.—JJH

02168 **Dreimanis, A.** Mastodons, their geologic age and extinction in Ontario, Canada: Canadian Jour. Earth Sci., v. 4, no. 4, p. 663–675, illus., tables, 1967.

Most Canadian occurrences of mastodons are from southern Ontario, with four-fifths found below Lake Warren shore, thus being younger than 12,400 yr B.P.; the youngest C-14 date is 8,910±150 yr B.P. Though most entered Ontario after the retreat of Wisconsin ice, a few may belong to the interstadials. Spruce pollen associated with mastodon bones, and their location in poorly drained lacustrine plains, suggest that mastodons preferred spruce forests. Their extinction might have

been initiated by gradual shrinking of these forests, and completed by their disappearance due to increasing warmth and dryness. They were separated from the northern boreal spruce forests by a wide belt of pine and hardwood which had developed over the better drained morainic areas.—*from* Author's abstract

02293 **Dunbar, Carl O.** (compiler). Publications by Raymond Cecil Moore, *in* Essays in paleontology and stratigraphy—R. C. Moore Commemorative Volume: Kansas Univ. Dept. Geology Spec. Pub. 2, p. 8–17, 1967.

Dunn, John R. *See* Beck, George L. 02076

11222 **Durham, J. Wyatt.** Evolution among the Echinoidea: Cambridge Philos. Soc. Biol. Rev., v. 41, no. 3, p. 368–391, illus., 1966.

A phylogenetic chart and classification system modified from that used in "Treatise on invertebrate paleontology, Pt. U" (Durham and others, 1966) is presented. The Ordovician genera *Bothriocidaris, Eothuria, Aulechinus, Ectinechinus* are considered true echinoids; the latter two are specialized early echinoids not close to the ancestral type. *Eothuria*, with no lantern, is placed in monotypic order Megalopoda, new superorder Megalopodacea. Characters of the ancestral echinoid are inferred from primitive characteristics that all or some of these genera have in common. The girdle and external gills of Echinothurioida indicate they are euechinoids allied to the diadematoids and not direct descendants of the Paleozoic Echinocystitoida (lepidocentroids). Principal evolutionary trends and modifications of plates and other features are discussed.—VMJ

02390 **Dyck, L. A.; Parker, B. C.** Comparisons of fossil and extant fructification of *Chara* [Pt.] 2, Physical and chemical characteristics [abs.]: Jour. Phycology, v. 3, supp., p. 10–11, 1967.

Dyck, L. A. *See* Parker, B. C. 02407

Easton, A. J. *See* Wolf, K. H. 02182

11167 **Edvalson, Fredrick M.** Sea floor names in principle and practice, *in* United Nations Regional Cartographic Conf. for Asia and Far East, 4th, Manila, 1964—V. 2, Proc. and Tech. Papers: New York, United Nations, p. 501–504, illus., 1966.

Bathymetry as a science has long been recognized as a branch of marine geology. The bathymetric chart is a primary tool for interpretation of the geologic structure and origin of 70 percent of the Earth's surface. The history and evolution of its nomenclature reflects the status of knowledge about the sea floor. The idea of a continental shelf appears to have originated during the 18th century. With the advent of echo soundings, the earlier concept of a flat sea floor was upset, and necessity for an accurate and universal system of nomenclature for submarine relief features became apparent. After early attempts, an intergovernmental committee in 1960 examined a list of 68 terms, defined and adopted 42 of them. A list agreed upon by an international GEBCO Advisory Committee follows a graphic illustration.—GDC

11185 **Eggert, Donald A.; Taylor, Thomas N.** Studies of Paleozoic ferns—On the genus *Tedelea* gen. nov.: Palaeontographica, v. 118, Ser. B, pts. 1–3, p. 52–73, illus., 1966.

Fertile parts of a frond of the pteridophyte formerly known, only from vegetative parts, as *Ankyropteris glabra* have been found in the Herrin coal of the Middle Pennsylvanian Carbondale Formation at Sahara mine, Carrier Mills, Ill. The specimen resembles primitive members of the Schizacaceae and Osmundaceae; it is here described as *Tedelea glabra*, type species of a new genus, and is transferred from Zygopteridaceae, Coenopteridales, to the new family Tedeleaceae, order Filicales. Most of the other species of *Ankyropteris* ultimately may prove to be closely related to *Tedelea*; in addition, several other genera with biseriate zygopterid anatomy may belong to the same natural group. No fertile parts have been indisputably referred to any of these genera. *Tedelea* does not seem closely related to any relatively completely known species of Coenopteridales.—VMJ

02209 **Eggler, David H.** Gravity survey of the Livermore–Tie Siding area, Colorado–Wyoming: Mtn. Geologist, v. 4, no. 3, p. 109–114, illus., table, 1967.

A Bouguer gravity map is presented of the northern Front Range–southern Laramie Range, Colorado–Wyoming. Regional values decrease from about −174 mgal in the northeast to −198 in the southwest. Hypothetical models of subsurface rocks were fitted to three gravity profiles across portions of the Virginia Dale ring-dike complex, a Precambrian structure consisting mostly of facies of Sherman Granite. It is suggested that the main Sherman batholith was emplaced as a series of sheet-like intrusions, and that the ring complex was emplaced by a combination of cauldron subsidence and central doming.—Author's abstract

Eglinton, G. *See* Murphy, Mary T. J. 02184

02053 **Eichholz, G. G.; Craft, T. F.; Galli, Ann N.** Trace element fractionation by suspended matter in water: Geochim. et Cosmochim. Acta, v. 31, no. 5, p. 737–745, illus., tables, 1967.

Fractionation of trace elements by silt and sediment particles in natural waters has been studied by means of radioactive tracers. Partition of the dissolved tracer ions between sediments and water was observed, as well as relative changes in concentration of fission product ions after contact with suspended particles in natural abundances. In waters with high organic content the pattern of fractionation is different. The results have an important bearing on the degree of self-purification by bottom sediments in turbulent polluted streams. Careful distinction is required in analytical reports between truly dissolved elements and total "dissolved solids", which may include ions adsorbed on submicron silt particles.—DBV

Ellis, Barbara Y. *See* Howard, Alan D. 02084

Ellison, R. L. *See* Nichols, M. M. 02189

02154 **Emery, K. O.** Estuaries and lagoons in relation to continental shelves, *in* Estuaries (edited by George H. Lauff): Am. Assoc. Adv. Sci. Pub. 83, p. 9–11, illus., 1967.

A brief comparison of regional aspects of estuaries and lagoons, a general description of continental shelves, and an examination of the varying position of sea level during the Pleistocene epoch are given. Lagoons are typical where continental shelves and coastlines are wide and nearly flat, and small estuaries where shelves and coastal plains are narrow and have high relief. Once formed, estuaries and lagoons tend to be destroyed by deposition at their heads and mouths, and by coastal retreat through marine erosion. Oceanographic observations support the concept that the continental shelves of today were cut during glacial times by waves of low sea level; similar features also are found above the present sea level. Modifications by fluctuating levels are suggested from cross sections of the deposits.—GDC

02247 **Emery, K. O.; Garrison, Louis E.** Sea levels 7,000 to 20,000 years ago: Science, v. 157, no. 3789, p. 684–687, illus., tables, 1967.

Relative sea levels for early post-Pleistocene time are best known from radiocarbon dates of sediments on the continental shelves off Texas and off northeastern United States. Differences in indicated rates of the rise of relative sea level and in depths of the shelf-breaks reveal differential vertical movement of the two shelves during this time, with the result that the Atlantic shelf has sunk with respect to the Texas shelf.—Authors' abstract

02251 **Emery, K. O.** The activity of coastal landslides related to sea level [with French abs.]: Rev. Géographie Phys. et Géologie Dynamique, ser. 2, v. 9, no. 3, p. 177–180, illus., 1967.

Coastal landslides require a sea cliff that has been steepened through undercutting by wave erosion. General considerations supported by some radiocarbon dates indicate that coastal landslides were much intensified about 5,000 years ago when sea level rose to near its present position. During most of the previous 20,000

years of glacially lowered sea level, waves attacked only the nearly horizontal surface of the continental shelf and could not produce extensive coastal landslides. Possibly for a small part of this period the shoreline lay below the top of the continental slope, and waves produced landslides and sea cliffs that now are deeply submerged. [The Palos Verdes Hills, Calif., is cited as an example.]—Author's abstract

Emiliani, Cesare. *See* Donn, William, 02360

01977 **Enjalbert, Henri.** Les montagnes calcaires du Mexique et du Guatemala [with English abs.]: Annales Géographie, v. 76, no. 413, p. 29–59, illus., 1967.

Karst landforms or dissected remnants of them in the high limestone mountains and plateaus of Mexico and Guatemala, where the altitude offsets the tropical latitude, are compared with karst areas of western Europe, particularly those of the Jura Mountains, the Cevennes, and the central Causse Méjan. The Sierra Madre in Oaxaca, and the Sierra Madre Oriental south of Monterrey, Mexico, and the Altos Cuchumatanes in Guatemala offer good examples of original karst. Chronology is as follows: Strong karstification developed during late Tertiary time. Orogeny at the end of the Tertiary was followed by large-scale dissection of surface features by streams following the limbs of parallel folds (the "ruz" of the Juras). During the Quaternary glaciations, above 2,800 m, the karst remnants were overlaid by frost-worked debris ("grèzes").—VMJ

02161 **Erdtmann, Bernd-Dietrich.** *Allograptus canadensis* n. sp.—Its significance to Lower Ordovician correlation: Canadian Jour. Earth Sci., v. 4, no. 4, p. 609–617, illus., table, 1967.

A declined four-branched graptoloid is referred to a new species of *Allograptus*, a genus of the family *Sinograptidae* described from the uppermost Lower Ordovician of China. This new Canadian species has been discovered from the upper Lévis Formation at Lévis, Quebec, and is the first representative of *Allograptus* in North America. A description of *A. canadensis* n. sp. is presented with a discussion on its possible significance for international stratigraphic correlation.—Author's abstract

Erickson, G. P. *See* White, William H. 02169

02147 **Ermanovics, I. F.** Statistical application of plagioclase extinction in provenance studies: Jour. Sed. Petrology, v. 37, no. 2, p. 683–687, illus., 1967.

Estimating the determining composition of plagioclase by a rapid extinction method using albite twin lamellae ⊥010 is successful, when treated statistically and cautiously, in establishing provenance area of a sediment. The method involves recording all symmetrical extinction angles of albite twin lamellae. Recording all symmetrical extinction angles allows detection of a polymodal population of plagioclase compositions. The apparent anorthite content of plagioclase in two conglomerate horizons and three granite bodies is used: to relate conglomerate horizons separated by a body of water, to relate both conglomerate horizons to a common provenance area (two of the granite bodies), and to show assimilation of conglomerate into the third granite body, allowing areal extension of the conglomerate palaeo-environment.—*from* Author's abstract

Ernst, W. G. *See* Appleman, D. E. 11130

11164 **Esten, Randall D.** Automated mapping systems, *in* United Nations Regional Cartographic Conf. for Asia and Far East, 4th, Manila, 1964—V. 2, Proc. and Tech. Papers: New York, United Nations, p. 329–356, illus., 1966.

The requirements for rapid large-scale topographic mapping will be partially satisfied by automated mapping systems being developed by the United States Army Corps of Engineers. Examples of developments in automatic type placement, automatic photogrammetric rectification, automatic mosaicking and automatic stereocompilation are described in detail in this paper. Application of these developments will make it possible to produce large-scale topographic maps at far greater speed.—Author's abstract

01932 **Evans, David M.** Man-made earthquakes—A progress report: Geotimes, v. 12, no. 6, p. 19–20, illus., 1967.

Earthquakes near Denver in the last two years, apparently triggered by injection into a deep disposal well at the Rocky Mtn. Arsenal, are being investigated. They range in magnitude from 1.0 to 4.8 on the Richter scale. Tremors have been observed also in the area of the Rangely oil field, where water is being injected, and earthquakes associated with the filling of Lake Mead have been known for years. Tremors felt near Georgetown, Colo., correlate with filling of the Cabin Creek reservoirs. Other examples are mentioned, including earthquakes due to subsidence in oil fields.—ESL

02311 **Evans, Robert.** The structure of the salt deposit at Pugwash, Nova Scotia [abs.]: Bull. Canadian Petroleum Geology, v. 15, no. 2, p. 211, 1967.

02306 **Evans, Thomas L.** A reconnaissance study of some western Canadian lead-zinc deposits [abs.]: Bull. Canadian Petroleum Geology, v. 15, no. 2, p. 208, 1967.

02312 **Ewing, Gerald N.** Seismic crustal studies in eastern Canada, the Gulf of St. Lawrence region [abs.]: Bull. Canadian Petroleum Geology, v. 15, no. 2, p. 211–212, 1967.

Eyring, Henry. *See* Hahn, Sang Joon, 02264

11145 **Fabregat G., Francisco J.** La sistemática mineral—Bosquejo histórico: Geología y Metalurgía, v. 3, no. 18, p. 9–24, illus., 1966.

A historical sketch of the development of mineral systematics is compiled, beginning with the dissertation on rocks and minerals by Theophrastus in the third century B.C. Works of Pliny the Elder (77 A.D.), Conrad Gesner (1565), Georgius Agricola (1530, 1546, 1556), and A. G. Werner (1817) are discussed, with illustrations, and fundamental works of numerous authors of the 19th and 20th centuries are mentioned briefly.—VMJ

02258 **Fahrni, Keith C.** Geology of the Granisle ore zone: Western Miner, v. 40, no. 5, p. 34–38, 1967.

The Granisle copper mine is in Mesozoic volcanic and sedimentary rocks that are intruded by Jurassic granite. Chalcopyrite and bornite are in Upper Triassic altered andesite and in felsic volcanic rock. Copper mineralization is closely related to a system of quartz filled fractures. Ore contains 0.533 percent copper and small amounts of gold and silver.—ARK

Faigle, George A. *See* Bluemle, John P. 01980

Fairbairn, H. W. *See* Hurley, P. M. 02043

Fairbairn, H. W. *See* Powell, J. L. 11128

Fairbridge, Rhodes W. *See* Chilingar, George V. 02099

Fan, Pow-Foong. *See* Swindale, L. D. 02009

Fang, H. Y. *See* Varrin, R. D. 01921

11148 **Faugères, M. L.** Observations dur le modelé des versants dans la région des Pitons du Carbet (Martinique): Assoc. Géographes Français Bull., nos. 342-343, p. 52–63, illus., 1966.

Catastrophic erosion and landslides were caused by hurricane Edith, Sept. 1963, on the slopes of the Pitons du Carbet, a group of pyramid shaped peaks of a dacitic volcanic massif, Martinique, W. I. A complex interaction of altitude, slope angles, vegetation zonation, and structure affect the slope evolution, despite geologic homogeneity. On the lower slopes of 50 to 60°, slides were extensive and deep; water-saturated soil flowed and shallow rooted trees fell tearing up blocks of

weathered dacite. On steeper slopes slides were shallow, because not enough weathered rock and soil could accumulate to hold water and vegetation. Summits have grass-covered slopes of 25 to 30° with thicker cover; many small landslides were starting points for gullies, but dacite was not exposed. The facetted slopes evolved by erosion along a system of diaclases resulting from tension along the Antillean island arc.—VMJ

02281 **Fay, Robert O.** Evolution of the Blastoidea, *in* Essays in paleontology and stratigraphy—R. C. Moore Commemorative Volume: Kansas Univ. Dept. Geology Spec. Pub. 2, p. 242–286, illus., 1967.

Blastoids range from Middle Silurian into Permian, and are worldwide in distribution. About 350 species have been described in 78 genera, 12 families, and two orders. The classification system given here is based on relative exposure and grouping of hydrospire fields; subfamilies are based upon arrangement of anal deltoid plates. The origin of the blastoids is unknown; both orders are represented in Silurian rocks: the Fissiculata with hydrospire fields exposed or constricted; the Spiraculata with hydrospires hidden, and with spiracles and pores. Phylogenetic charts are given, and evolutionary trends in shape, major plates, hydrospires and spiracles are illustrated in detail for each order.—VMJ

02236 **Fisher, John J.** Terrestrial pseudokarst and the lunar topography—Discussion [of paper by W. R. Halliday, 1966]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 115–116, 1967.

That lava tubes seldom show any surface indication, or lineation generated by collapse features, may be true for certain lava fields but may not hold for lava fields on the Moon. Extending some of Halliday's ideas (ibid., v. 28, no. 4, p. 167–170, 1966), observations made in the Arco part of Craters of the Moon in Idaho are cited. Indian Tunnel has numerous collapse sinks along its entire length of almost 1,000 feet. The recently discovered Arco Tunnel, over a mile in mapped length, has only one collapse sink, this over 100 feet in diameter; a definite surface bulge in the pahoehoe appears to trend in the same direction as the underground passages. The difference may lie in its being a more recent flow that has not been buried by others. The lesser gravity field on the Moon might tend to develop similar but larger and more extensive tubes.—GDC

02305 **Fitzgerald, E. L.; Peterson, D. J.** Inga Oil Field, British Columbia: Bull. Canadian Petroleum Geology, v. 15, no. 1, p. 65–81, illus., 1967.

Oil was discovered in commercial quantities at Inga in January 1966. Up to the middle of February 1967, 30 wells had been drilled in and near the Inga oil field to test productive sandstones in the Upper Triassic Charlie Lake Formation. Of these, 19 have been completed as oil wells, 2 encountered gas, and 9 were abandoned. Production is obtained from a thin quartzose sandstone, herein named the Inga Member, situated near the middle of the Charlie Lake Formation. Some oil also occurs in a newly named, slightly younger, Coplin Member. The trap is associated with Laramide fold structures which are modified as a result of rapid thinning of the intervening section across the area. Oil production is limited on the Inga anticline and adjacent structure by gas caps; the western edge and part of the eastern boundary are determined by porosity loss.—*from* Authors' abstract

02041 **Flanagan, F. J.; Gwyn, M. E.** Sources of geochemical standards: Geochim. et Cosmochim. Acta, v. 31, no. 7, p. 1211–1213, table, 1967.

Information on the type of sample, the source, and the sample numbers is compiled for geochemical standards currently available from 12 sources in different parts of the world.—DBV

02024 **Flores, Romeo M.** Relationship of geometry to the origin of the Lower Freeport sandstone (middle Allegheny) of eastern Ohio: Jour. Sed. Petrology, v. 37, no. 2, p. 624–632, illus., tables, 1967.

Channel sandstones are mainly fluvial in origin and increase significantly in thickness and width in a sequence of stratigraphic sections extending from southern to northeastern Ohio.—RAC

01995 **Forgotson, J. M., Jr.; Iglehart, C. F.** Current uses of computers by exploration geologists: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 7, p. 1202–1224, illus., tables, 1967.

This paper illustrates the methods and techniques used in six types of current geologic applications of computers: (1) geologic data retrieval—of Gulf Coast micropaleontological data; (2) structural and isopachous mapping—involving 1,000 wells in a four county area; (3) facies mapping—preparing lithofacies and target maps; (4) factor analysis—to reduce and simplify complex sets of data; (5) trend analyses—constructing maps of regional structural trends and residual maps showing positive and negative anomalies; and (6) gravity and magnetic interpretations—calculating residuals and derivatives, and automatic plotting and contouring by combining computers with electronic plotting equipment.—BHK

Fox, J. S. *See* Philpotts, A. R. 02042

01976 **Fox, William T.** FORTRAN IV program for vector trend analyses of directional data: Kansas Geol. Survey Computer Contr. 11, 36 p., illus., tables, 1967.

A computer program for the IBM 7090/7094 uses orthogonal polynomial trend-surface mapping techniques. Direction cosines are used for each cell in the grid to compute the vector mean azimuth, mean dip angle, length of resultant vector, and spherical radius of the circle of confidence around the resultant vector. Linear, quadratic, cubic, quartic, and quintic orthogonal polynomial response surfaces are plotted as isoazimuth and vector trend maps to interpret regional flow patterns. The first example uses cross-bedding measurements from the Wasatch Formation, Wyoming; a second is based on orientation of drumlins south of Lake Ontario, New York, and the third uses cross-bedding measurements from the Pocono Formation, Pennsylvania. In the last two, linear, quadratic, and cubic isoazimuth and vector trend maps are used to interpret the major current pattern, and residual maps to outline topographic highs or lows.—*from* Author's abstract

02118 **Frarey, M. J.** Three new Huronian formational names: Canada Geol. Survey Paper 67-6, 3 p., 1967.

This brief report presents three new formational names which are applied to early Huronian rocks north of Lake Huron. Two of the names are applied to long-established but unnamed units and the third is given to a recently redefined formation.—Author's abstract

02260 **Frazer, N. H. C.** Geology of the Wexford property, Gaspé area, Quebec: Canadian Mining Jour., v. 88, no. 4, p. 118–120, 1967; also in Mining in Canada, p. 41–42, April 1967.

In this area, Devonian granite and associated felsic rocks have intruded and altered sediments and volcanic rocks of Ordovician age. Most of the copper (chalcopyrite and bornite) is in highly fractured hornfels that also contains much pyrite and pyrrhotite. Galena and sphalerite are present also.—ARK

01965 **Frebold, Hans.** Hettangian ammonite faunas of the Taseko Lakes area, British Columbia: Canada Geol. Survey Bull. 158, 35 p., illus., tables, 1967.

Hettangian ammonites, part of a Jurassic collection made by H.W. Tipper and E.T. Tozer in 1963–64 in the Taseko Lakes area, are described and assigned to: *Phylloceras* sensu lato, *Eolytoceras* n.gen., *Psiloceras* sensu stricto, *Psiloceras* (subgenus *Curviceras*), *Discamphiceras*(?), *Paracaloceras*, *and Charmasseiceras*; most are represented by several new species. With one exception, none of the species could be specifically identified with species characteristic of Hettangian beds in the Alps. The Hettangian of the Taseko Lakes area is tentatively subdivided into two zones: a lower with *Psiloceras* ex aff. *P. planorbis* (Sowerby), and an upper with *Phylloceras*,

Eolytoceras, Psiloceras canadense, and species of *Psiloceras (Curviceras), Discamphiceras(?), Paracaloceras, and Charmasseiceras.*—*from* Author's abstract

02380 **Frebold, Hans; Tipper, H. W.** Middle Callovian sedimentary rocks and guide ammonites from southwestern British Columbia: Canada Geol. Survey Paper 67-21, 29 p., illus., tables, 1967.

The presence of middle Callovian rocks and guide ammonites is established in the Harrison Lake, Taseko Lakes, and Nechako River areas of southwestern British Columbia. Deposits of this age are not known from other parts of Canada except from Vancouver Island. Although lower Callovian beds are widely distributed in the Rocky Mountains, the Canadian Arctic, and Queen Charlotte Islands, such beds have so far not been identified in those areas where middle Callovian is present.—Authors' abstract

02051 **Freedman, Helen W.** A statistical discussion of P residuals from explosions, Pt. 2: Seismol. Soc. America Bull., v. 57, no. 3, p. 545-561, illus., tables, 1967.

Explosions at large distances from a seismic array have been studied in an attempt to obtain an estimate of a P-traveltime "adjustment" function for each station in the array relative to a standard P-table. The probability distribution of residuals is discussed and some error estimates for station adjustments given. A method is suggested for relocating groups of events occurring in small regions, because there have been groups of explosions in small regions which gave rise to widely varying sets of residuals. It is questionable whether a meaningful adjustment function for a single station can be obtained at all when azimuthally varying source as well as station terms are present.—DBV

02064 **Freedman, Helen W.** Estimating the accuracy of source "parameters": Seismol. Soc. America Bull., v. 57, no. 3, p. 373-379, illus., tables, 1967.

This paper suggests a method for estimating the errors accompanying estimates of seismic source parameters. While the method is a general one, the data here are from 1962 and 1963 and special attention is given to a few regions, such as the Kuriles. The overall standard error of about one-half a degree in each coordinate and four seconds in origin time are broken down and analyzed in terms of magnitude, depth, and location in space and time. The most accurately located earthquakes appear to be those of intermediate depth and magnitude in highly seismic areas. There is some indication that these errors are decreasing with time.—DBV

11165 **Fretcher, Karl W.** "Color-Trol" for topical mapping—Addendum No. 16 *in* United Nations Regional Cartographic Conf. for Asia and Far East, 4th, Manila, 1964—V. 2, Proc. and Tech. Papers: New York, United Nations, p. 470-472, illus., 1966.

Hues for the geologic age periods have become standard worldwide as a means of illustrating the age of lithologic units in mapping. Symbol patterns have definite geologic meanings, such as stipples for certain sedimentaries, and gratings for fossil clastics. Since Powell's remarkable system was proposed at the time of his tenth annual report (1890) as Director of the United States Geological Survey, mechanics of graphic arts have changed. By reducing hues to tri-color tints with halftone combinations of a limited number of symbol patterns, as done in the Philippines, the total geologic spectrum with symbol patterns for rock classification of all surficials, fossil clastics, base complex and volcanics, properly illustrated geology can be achieved, adaptable to a simple code language.—GDC

02025 **Friedman, Gerald M.** Dynamic processes and statistical parameters compared for size frequency distribution of beach and river sands: Jour. Sed. Petrology, v. 37, no. 2, p. 327-354, illus., tables, 1967.

Sand samples from beach and from river environments have different grain-size distribution properties which reflect differences in modes of transportation and deposition. Grain-size distribution measures found to be sensitive to environmental differences include: third moment, mean cubed deviation, standard deviation,

graphic skewness, graphic standard deviation, and the new measures simple skewness and simple sorting. Graphic correlation of these with other measures showed only 5 to 13 percent of the sample correlation points as falling outside the assigned environmental boundaries on the graphs. RAC

11155 **Fristrup, Børge.** The Greenland Ice Cap: Copenhagen, Rhodos Internat. Sci. Publishers, 312 p., illus., 1966.

This book on the Greenland Ice Cap, consisting of 19 chapters, deals with the history of exploration and investigations of the ice sheet: Danish, French, and British expeditions; American investigations; stations and ice tunnels; the International Glaciological Expedition; and the area, distribution, climate, thickness, movement, age, regimen, and formation of the ice sheet. The Greenland Ice Cap, which is the only really large ice sheet outside Antarctica, comprises an area of 650,000 sq mi and has an average thickness of 4,800 feet. It was the first ice sheet studied and is now the best known of all major ice areas. LLP

02149 **Frost, Jack G.** A negative replication for electron microscopy study of carbonates: Jour. Sed. Petrology, v. 37, no. 2, p. 692–695, illus., 1967.

A technique is described for the preparation of negative replicas for electron microscope study of carbonate rocks. Replicas are produced from carbonate rocks by chromium shadowing the replicating surface and then covering it with a carbon film which is scored into squares. The film is released by a versene (EDTA) solution which does not liberate CO_2, thus causing no damage to the replicas. The replicas preserve textural details and are simple and rapid to prepare. The method is applicable to limestones and dolomites of all types. Author's abstract

02287 **Frye, John C.; Leonard, A. Byron.** Buried soils, fossil mollusks, and Late Cenozoic paleoenvironments, *in* Essays in paleontology and stratigraphy R. C. Moore Commemorative Volume: Kansas Univ. Dept. Geology Spec. Pub. 2, p. 429–444, 1967.

Paleoenvironments of continental interior regions are difficult to reconstruct from a single line of evidence, which may lead to specialized or restricted conclusions. Two complementary (not produced for the same time interval) sets of data, molluscan faunas and buried soil profiles, here illustrated by the Sangamon Soil, can be used to reconstruct a nearly continuous sequence of paleoenvironments during late Cenozoic time in the central interior region of the United States. Indication of wetter and cooler conditions by the fossil faunas than by soils in the same area is consistent with evidence from regional stratigraphy; the major soils were formed during interglacial intervals and the fossiliferous deposits during glacial advance and retreat. VMJ

Fujiyama, Chikako. *See* Yamasaki, Fumio, 02220

02197 **Furbish, William J.** Chloritoid from Orange County, North Carolina: Southeastern Geology, v. 8, no. 2, p. 53–66, illus., 1967.

A select chloritoid occurrence from the Duke University quarry, Hillsborough, is discussed. Although a continuous gradational deposition sequence exists, it is discussed for clarity as consisting of three types: chloritoid in rocks with no fractures, in rocks with fractures, and in vein fillings. The chemical components of some of the metavolcanic metasedimentary rocks of the Carolina slate belt are plotted against the chemical component concentration field for chloritoid bearing rocks, and a large percent are similar. Chloritoid forming constituents were considered to have been mobile and formation of chloritoid took place during but late in the metamorphic history of the area. Conditions of high aluminum and iron concentration existed and possibly high oxygen pressure. *from* Author's abstract

Fyles, J. G. *See* Lowdon, J. A. 02216

Gable, D. J. *See* Sims, P. K. 02044

Galli, Ann N. *See* Eichholz, G. G. 02053

Gamble, E. E. *See* Daniels, R. B. 02198

11146 **García Gutiérrez, Carlos.** Los diques clásticos: Geología y Metalurgía, v. 3, no. 18, p. 25–34, 1966.

Clastic dikes, including sandstone dikes, are defined, and a proposed classification system is outlined. The dikes are classified by: form, origin of fissures, enclosing rocks, clastic material of the filling, process of intrusion, and relative direction of intrusion of filling; items under each category are briefly explained. Even though the names clastic dike and clastic intrusion are in common use and cover sufficiently the structures noted above, it would be well to consider the possibility of adopting for them the generic name of secondary intrusion; this name would permit inclusion of salt domes, which also should be considered as bodies injected into younger strata, although salt is not a clastic material.—VMJ

Garrell, H. A. *See* Harding, S. R. L. 02237

Garrison, Louis E. *See* Emery, K. O. 02247

Gast, Paul W. *See* Hanson, G. N. 02038

01969 **Gees, R. A.** Graphic presentation of sedimentary mixtures containing four components [with German, French, and Russian abs.]: Geol. Rundschau, v. 56, no. 2, p. 696–701, illus., tables, 1967.

In a modified method of graphic presentation of four component sedimentary mixtures in a "concentrated tetrahedron", ten wedge shaped sections pass through one edge and cut the opposite edge into ten equal parts. Points are plotted on the intermediate plane of each section. The intermediate sections are isosceles triangles, assumed to be equilateral inasmuch as relative position of points is the same. The symmetrical sections are rotated into a plane on the axis of the first edge of the tetrahedron to form parallelograms; the triangles are arranged according to increasing ratios represented by the two opposite corners. A considerable number of samples can thus be plotted on the same graph; but five graphs are necessary to cover the full range of compositional changes.—GDC

George, P. T. *See* Brown, D. D. 02381

George, P. T. *See* Bennett, G. 02383

Gerry, Ephraim. *See* Wise, Charles D. 01950

Gibbs, G. V. *See* Appleman, D. E. 11130

01963 **Giblin, P. E.; Leahy, E. J.** (compilers). Sault Ste. Marie Elliot Lake sheet (geological compilation series), Algoma, Manitoulin and Sudbury Districts: Ontario Dept. Mines Map 2108, scale 1:253,440, sections, text, 1967.

The Sault Ste. Marie Elliot Lake area contains deposits of bismuth, clay, cobalt, copper, gold, gravel, iron, kaolin, lead, manganese, molybdenum, nickel, niobium, sand, silica, silver, thorium, trap rock, uranium, yttrium, and zinc. Present mineral production data and a list of past and present producing mines are included on the map sheet.—MCM

Gibson, R. C. *See* Martin, N. W. 11203

02364 **Gilliam, Harold.** The natural world of San Francisco: Garden City, N. Y., Doubleday and Co., 256 p., illus., 1967.

The natural world of San Francisco is described in five parts: land and waters, trees, parks, wildlife, and sky. Part 1, a popular account of the land and marine geology around the city, describes the Franciscan rocks, faults, blocks, dipping beds,

moving dunes, "river of sand," ocean margins, mystery of Great Bar, the green ridge, deep lagoon, and the beach on the hill.—LLP

Ginsburg, R. N. *See* Stockman, K. W. 02144

01938 **Girault, Jean; Chaigneau, Marcel.** Sur les inclusions fluides présentes dans les cristaux d'apatite des roches de la région d'Oka (Canada): Acad. Sci. Comptes Rendus, ser. D, v. 264, no. 4, p. 529–532, illus., 1967.

Elongated and spherical inclusions rich in CO_2 were formed contemporaneously with their host apatites and have the same composition. It is concluded that the apatites crystallized in the presence of one or more fluid phases and that the rocks of the Oka complex containing apatite with fluid inclusions were derived by differentiation from a common source.—GWL

11123 **Girault, Jean.** Sur la genèse des cristaux d'apatite des carbonatites d'Oka (Canada): Acad. Sci. Comptes Rendus, ser. D, v. 263, no. 2, p. 97–100, 1966.

The apatite crystals in the Oka carbonatites in Quebec show two distinct facies: short, poorly formed crystals, and generally well-formed acicular crystals. Both types contain spheroidal single-crystal inclusions of calcite. Similar facies have been synthesized by Wyllie and Tuttle and by Wyllie, Cox and Biggar, under well-defined pressure and temperature conditions and in the presence of liquid phases. This supports the theory that the Oka carbonatites crystallized from a medium that was at least partially fluid.—DBV

02166 **Gittins, J.; Macintyre, R. M.; York, D.** The ages of carbonatite complexes in eastern Canada: Canadian Jour. Earth Sci., v. 4, no. 4, p. 651–655, illus., tables, 1967.

There are four chronological groups of carbonatite complexes in Ontario and Quebec [determined by K-Ar dating]. These are about 125 m.y., 565 m.y., 1,075 m.y., and 1,700 m.y., with a possible fifth at 1,560 m.y. The recently proposed St. Lawrence Rift System is not considered to be a very likely control of carbonatite emplacement unless it includes a widespread system of branch faults. The coincidence of carbonatite complexes with the "Kapuskasing High" is striking and probably puts a minimum age of 1,750 m.y. on the feature. Niobium is found in carbonatites of each age group.—Authors' abstract

Gittins, J. *See* Tuttle, O. F. 11170

11177 **Gittins, J.** Russian views on the origin of carbonatite complexes, *in* Carbonatites (O. F. Tuttle and J. Gittins, editors): New York, Interscience Publishers, p. 379–382, 1966.

Russian views, which are probably influenced by ultrabasic alkalic carbonatite complexes of Siberia, favor an extreme metasomatic origin for carbonatites. The rocks of the complex are believed to be formed by a series of metasomatic transformations in zones surrounding an ultrabasic plug. The concentric arrangement of rock types indicates a metasomatic rather than a comagmatic origin. The stages of the processes are: (1) Na-Ca metasomatism and nephelinization, (2) K-Ca metasomatism, (3) breakdown of previously formed minerals and appearance of calcite, (4) early calcite carbonatite, (5) late calcite carbonatite, (6) calcite dolomite carbonatite, and (7) ankerite and ankerite siderite carbonatite. It is concluded that the rocks themselves are the main source of the calcium in the carbonatites.—LLP

02317 **Globensky, Yvon Raoul.** Upper Mississippian non-carbonate microfauna from the Windsor Group of the Atlantic Provinces [abs.]: Bull. Canadian Petroleum Geology, v. 15, no. 2, p. 213–214, 1967.

02037 **Goguel, Jean.** Les recherches françaises d'energie géothermique à la Guadeloupe: Bull. Volcanol., v. 30, p. 233–241, illus., 1967.

The progress of geothermal investigations on Guadeloupe is outlined. A high temperature zone in the Bouillante Plain could be due to either of two causes, one favorable and the other unfavorable to the possibility of finding utilizable geothermal energy. Temperature profiles have been measured in a number of wells, but the investigations have not yet reached a stage at which a decision can be made between the two possibilities.—DBV

Goldberg, E. D. *See* Delany, A. C. 02341

Golden, H. G. *See* Newton, J. G. 11218

02340 **Goldsmith, Julian R.** Metastability and hangovers in crystals: Geochim. et Cosmochim. Acta, v. 31, no. 6, p. 913–919, illus., 1967.

Many natural materials maintain metastable configurations (and/or compositions) for geologically long periods of time. A number of common minerals have this hangover problem, mostly because of the rather small differences in energy level of the metastable and stable configurations, or because of low diffusion rates and large energy barriers between the two states, or both. Examples are given showing that the hangover problem exists at both ends of the temperature range.—DBV

02388 **Goldstein, Joseph I.; Short, James M.** Cooling rates of 27 iron and stony-iron meteorites: Geochim. et Cosmochim. Acta, v. 31, no. 6, p. 1001–1023, illus., tables, 1967.

A method for precise determination of the cooling rate of iron and stony-iron meteorites has been developed and applied to 18 irons, 8 pallasites, and 1 siderophyre. A very wide range of cooling rates was found (0.4° to 40° per 10^6 yr). Three approximate groupings were noted, indicating that various iron and stony-iron meteorites developed their Widmanstätten structure in different thermal environments, although each meteorite was insulated within a parent body to a temperature less than 350°C. The differences in cooling rates may be due to varying depth of burial within one or several parent bodies, or to cooling in the cores of several parent bodies.—DBV

11154 **Goldthwait, R. P.** Evidence from Alaskan glaciers of major climatic changes, *in* World Climate from 8000 to 0 B. C.—Internat. Symposium, London, 1966, Proc.: London, Royal Meteorol. Soc., p. 40–53, illus. [1966?].

Detailed studies have been made in Glacier Bay on the wet side of the mountains of southeastern Alaska, and the Icefield Ranges on the dry side in Yukon. In unconsolidated drift of Muir Inlet and Lituya Bay, basal Wisconsin boulder clay lies on marine clays; radiocarbon dates, 8400 to 7100 B.C., parallel glacier history farther northwest. Kaskawulsh Glacier on the dry side had retreated far by this time, with great alluvial fans; loess contained bones indicating dry climate 2° cooler than Glacier Bay. Throughout hypsithermal time, glaciers were smaller in all areas except northwestern Glacier Bay; all recessed valleys filled with outwash. A bog above Kaskawulsh Glacier records pollen changes back to wetter conditions in 1380 B.C. Glaciers extending into Glacier Bay impounded a lake in Muir Inlet dated 2200 to 250 B.C. Neoglaciation was climaxed in a series of pulses mostly between A.D. 1500 and 1850.—GDC

Goodell, H. G. *See* Knauer, G. A. 02213

Goodell, H. G. *See* Huang, Ter Chien, 02034

02156 **Gorsline, D. S.** Contrasts in coastal bay sediments on the Gulf and Pacific Coasts, *in* Estuaries (edited by George H. Lauff): Am. Assoc. Adv. Sci. Pub. 83, p. 219–225, 1967.

Mobile Bay, Ala., is a classic estuary; Florida Bay a lagoon behind a fringing reef; and Apalachicola Bay, Fla., a composite of a true estuary, barrier island lagoons, and open coastal embayments. Estuaries, coastal indentations where tidal circulation generally prevails over land runoff, are triangular-shaped broad mouths of drowned river valleys. The length of an estuary's life will be determined by the rate of sedimentation from terrestrial or marine sources. Where large volumes are brought in by streams, the typical coastal feature will be a delta. General coastal

configuration is a factor, since rugged coasts like the Pacific have narrow shelves, sea cliffs, fjords or rias. The Gulf and Atlantic Coastal Plains are broader and more complex. The Florida Peninsula is a carbonate plateau, quite different in detail.—GDC

02005 **Gow, Kenneth L.** Irvine E. Stewart (1893–1965): Am. Assoc. Petroleum Geologists Bull., v. 51, no. 7, p. 1373–1374, portrait, 1967.

Grady, John R. *See* Orr, Wilson L. 02040

02352 **Gradziński, Ryszard; Radomski, Andrzej.** Spostrzeżenia nad rozwojem jaskiń i krasu kopiastego w Sierra de los Organos na Kubie: Acta Geol. Polonica, v. 17, no. 2, p. 273–292, illus., French résumé, p. 293–295, 1967.

Near Sumidero southwest of Havana, Cuba, the caves formed in the karsted Viñales limestones of the Sierra de los Organos appear to be of a transfluent type: their development is due to subterranean streams. Two levels of caves are discerned, the upper in dry benches of former stream levels; their characteristic features are described, particularly in relation to surface rivers, corridor patterns, direction of flow of water, grooves and precipitations, and alluvial deposits. The importance of the regional condition of the karst for the formation of caves of this type is stressed. There are many oval depressions, locally called hoyos, in a chain of mogotes. The origin of these internal poljes is closely related to the development of transfluent caves.—GDC

02054 **Greenland, L.** The abundances of selenium, tellurium, silver, palladium, cadmium, and zinc in chondritic meteorites: Geochim. et Cosmochim. Acta, v. 31, no. 5, p. 849–860, tables, 1967.

The abundances of the elements Se, Te, Ag, Pd, Cd, and Zn have been determined in a number of carbonaceous, enstatite, and ordinary chondrites by a neutron activation technique. Of these, only palladium is essentially unfractionated among the various chondrite groups; the fractionation of the other elements is generally consistent with the model proposed by Anders [1964].—Author's abstract

02356 **Gregory, A. R.** Mode conversion technique employed in shear wave velocity studies of rock samples under axial and uniform compression: Soc. Petroleum Engineers Jour., v. 7, no. 2, p. 136–148, illus., tables, 1967.

A shear wave velocity laboratory apparatus and techniques for testing rock samples under simulated subsurface conditions have been developed. S and P wave velocity measurements on Bandera sandstone and Solenhofen limestone are reported for the axial pressure range 0 to 6000 psi and for the uniform pressure range 0 to 10,000 psi. The influence of liquid pore saturants on P and S wave velocity is found to be in broad agreement with Biot's theory; in specific areas, the measurements do not conform to theory. In general, velocities measured under uniform stress are higher than those measured under axial stress. Liquid pore fluids cause increases in Poisson's ratio and the bulk modulus but reduce the rigidity modulus, Young's modulus, and the bulk compressibility.—*from* Author's abstract

01944 **Gregory, Gardiner.** The famous pegmatites of Newry, Maine: Gems and Minerals, no. 359, p. 22–24, illus., 1967.

The history and geology of pegmatite in the town of Newry, Oxford County, Maine, are reviewed. About 110 minerals have been identified from the area, including some rare phosphates. Principal ones described are beryl, tourmaline, feldspar, and rose quartz.—ESL

02329 **Gresens, Randall L.** Tectonic hydrothermal pegmatites [Pt.] 1, The model: Contr. Mineralogy and Petrology, v. 15, no. 4, p. 345–355, illus., 1967.

The proposed model for genesis of complex zoned pegmatites depends on two basic conditions: an alkali chloride intergranular fluid phase (of magmatic or metamorphic) in equilibrium with solid phases in the host rock, and deformation producing low pressure zones in the host rock. Depending on phase

relations of quartz mica feldspar, the reaction is fed by diffusion of hydrothermal alkali chloride solutions into the low pressure zone; if rate of dilation is slow, only quartz will migrate there. A higher rate will cause the reaction to proceed. Thus, the quartz core is first to crystallize, then quartz veins that grade laterally into pegmatite. Rare elements in pegmatites may have four sources: hydrothermally introduced solutions, impurities adsorbed to mineral grains in country rock, elements released by recrystallization of country rock, and elements released by reactions.—GDC

Grey, Donald C. *See* Haynes, C. Vance, Jr. 02211

Griffin, A. A. *See* Halliday, Ian. 02115

Griffin, A. A. *See* Halliday, Ian. 11214

Griffin, J. J. *See* Delany, A. C. 02341

02086 **Guilday, John E.; McCrady, Allan D.** Vertebrate fossils from Appalachian caves and their implication to Pleistocene geology [abs.]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 105, 1967.

02371 **Guillet, G. R.** Industrial minerals, *in* Operating Kapuskasing: Ontario Dept. Mines Misc. Paper MP 10, p. 74–98, illus., tables, 1967.

Industrial minerals are potentially important in the Kapuskasing Moosonee area of Ontario, particularly in the Mesozoic and Paleozoic formations of the Moose River basin. Large reserves of kaolin, fireclay, silica sand, lignite, gypsum, limestone, common clay, peat moss, and sand and gravel are present. Occurrences are described briefly or referred to published reports. The high quality of many of these commodities has been established. Recent activities are recorded in unpublished reports on open file in Timmins and Toronto offices of the Ontario Department of Mines.—GDC

Gwyn, M. E. *See* Flanagan, F. J. 02041

Hackner, Betty L. *See* Langenheim, Jean. 01937

02264 **Hahn, Sang Joon; Ree, Taikyue; Eyring, Henry.** Mechanism for the plastic deformation of Yule marble: Geol. Soc. America Bull., v. 78, no. 6, p. 773–781, illus., table, 1967.

Two independent mechanisms are assumed to be involved: one is the dislocation movement inside crystal grains, and the other is the sliding along grain boundaries due to applied stresses. The first predominates at low temperatures and high stresses and the second at high temperatures and low stresses. The two combined mechanisms correspond to two Maxwell units in series, which is used to explain experimental plastic deformation at strain rates ranging from 3×10^{-7} sec to 4×10^{-1} sec at 20°–800°C. The rate determining step for both mechanisms is the self diffusion of calcium and carbonate ions surrounding the "bad sites" where the dislocation lines are held up and grains stick strongly.—RAL

01989 **Haines, G. V.** A Taylor expansion of the geomagnetic field in the Canadian Arctic: Dominion Observatory Ottawa Pubs., v. 35, no. 2, p. 119–140, illus., tables, 1967.

Data from an aeromagnetic survey of the Canadian Arctic in 1963, were used to obtain non orthogonal Taylor series expansions of 1st, 2nd, and 3rd degrees by the least squares method. The basic analysis was carried out in mutually perpendicular components U, V, and Z, where U and V are horizontal components referred to the Greenwich Grid system and Z is the vertical component. A comparison with the Canadian Magnetic Charts showed that the R. M. S. differences in D, H, and Z were less than the standard errors of estimate. The magnetic pole position determined from the 3rd degree expansion is 13 miles from the accepted position for 1964.0. A correction for disturbance, over an area of 0.16 million square

miles, resulted in a 20γ decrease in standard error of U but no significant change in errors of V and Z.—*from* Author's abstract

02325 **Häkli, T. A.; Wright, Thomas L.** The fractionation of nickel between olivine and augite as a geothermometer: Geochim. et Cosmochim. Acta, v. 31, no. 5, p. 877–884, illus., tables, 1967.

The coexisting olivine, clinopyroxene, and glass of five samples collected from the Makaopuhi lava lake in Hawaii, at temperatures of 1,050°–1,160°C were analyzed for Ni with an electron probe microanalyzer. The results strongly suggest that the distribution of nickel between these three phase pairs well obeys the thermodynamic partition law, and that under favorable conditions, the distribution coefficients permit the estimation of the crystallization temperature within an accuracy of 10°–20°C. Application of the Makaopuhi data to plutonic and to other volcanic rocks should be carried out with caution, as the effect of pressure and the changing composition of the phases on the distribution coefficients is not known quantitatively.—*from* Authors' abstract

01923 **Halbouty, Michel T.** Heritage of the petroleum geologist: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 7, p. 1179–1184, 1967.

The heritage left us by the early petroleum geologists has been ignored and practically forgotten. Those geologists should be remembered for having been well-rounded, true geologists who applied all facets of our science to their endeavors. In order to meet exploration requirements of the future, the profession must develop more original ideas, and not be afraid to push those ideas forward into fruition. We must once again become true geologists—well rounded and knowledgeable. It is only then that we can emulate successfully our predecessors, and pay our debt to them for the inheritance which they left us and our debt to our profession for the heritage that we build upon and leave for our successors.—*from* Author's abstract

02115 **Halliday, Ian; Griffin, A. A.** Summary of drilling at the West Hawk Lake crater: Royal Astron. Soc. Canada Jour., v. 61, no. 1, p. 108, illus., 1967.

The results from a second diamond drilling operation at West Hawk Lake, Manitoba, are described. Two of three attempted holes penetrated the sediments beneath the lake and provide further data on the structure of this ancient meteorite crater. The present lake basin was probably derived by severe erosion of a crater originally 9,000 feet in diameter.—Authors' abstract

11214 **Halliday, Ian; Griffin, A. A.** Preliminary results from drilling at the West Hawk Lake crater: Royal Astron. Soc. Canada Jour., v. 60, no. 2, p. 59–68, illus., 1966.

Further evidence for the meteorite impact origin of West Hawk Lake has been obtained from preliminary study of the core recovered from drilling at the lake center. Some 300 feet of sediments were found to cover a 1,000 ft layer of brecciated rock, beneath which a further 700 feet of cracked rock was found. Some sections of the core show deformations typical of the extreme pressure associated with meteorite crater formation.—Authors' abstract

02078 **Halliday, William R.** Geology of Oregon Cave, Oregon [abs.]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 98, 1967.

02203 **Halliday, William R.** Terrestrial pseudokarst and the lunar topography—Reply [to 1967 discussion by J. J. Fisher of 1966 paper]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 117, 1967.

It does appear possible that in the unusual case of lack of covering of a tube-forming flow, linear bulges may be important, but they are very uncommon in the Peterson White Salmon and the Mt. St. Helens flows of Washington. Differences in origin suggested by subsurface morphology in Idaho (ibid., p. 115–116), is also suggested within the small area of the Peterson flows by super imposed multilevel caverns and other complexes, but local factors as well as geomorphic variations will have to be considered. As to lunar tube caverns, the lesser gravity may be

of minor significance in view of the plasticity of pahoehoe under conditions which may be those of early vulcanospeleogenesis. Lack of oxygen would suggest lower flow temperatures as in terrestrial flows. (Original paper, ibid., v. 28, no. 5, p. 167–170, 1966.)—GDC

Ham, William E. *See* Toomey, Donald Francis, 02402

Hamada, Tatsuji. *See* Yamasaki, Fumio, 02220

02020 **Hampton, Monty A.; Colburn, Ivan P.** Directional features of an experimental turbidite fan, a report of progress: Jour. Sed. Petrology, v. 37, no. 2, p. 509–513, illus., table, 1967.

Significant radial orientation of sand grains was produced in an artificial subaqueous turbidite fan. Experiments aimed at reproducing sole markings and traces of initial flow patterns of a turbid current have been, to date, unsuccessful.—RAC

02029 **Hand, Bryce M.** Differentiation of beach and dune sands, using settling velocities of light and heavy minerals: Jour. Sed. Petrology, v. 37, no. 2, p. 514–520, illus., 1967.

Marine foreshore and dune sands from New Jersey are distinguished by comparing settling velocities of two or more minerals of differing densities that occur together. Good environmental separation is obtained by plotting delta values (log median settling velocity of the selected mineral minus log median velocity of associated quartz) against log median quartz velocity. A straight line drawn on such a scatter diagram containing delta values for hornblende from 48 dune and marine beach samples properly classified all but four samples. The technique requires neither paired sampling of adjacent environments nor statistical evaluation of groups of samples. The parameter should reflect the environment immediately responsible for deposition.—*from* Author's abstract

02068 **Hansen, Arnold J., Jr.** Availability of ground water in the Cayce quadrangle, Jackson Purchase region, Kentucky–Tennessee: U.S. Geol. Survey Hydrol. Inv. Atlas HA-180, scale 1:24,000, section, text, 1967.

Ground water for domestic, agricultural, and industrial use is abundant in the Cayce quadrangle, principally from Eocene sand. Sparse data suggest the strata are from 900–1,400 feet thick and dip southwestward about 30 feet per mile; yields vary from 100–1,700 gpm. The quality of water in the main zone of saturation is satisfactory for most uses; that of perched water depends upon local factors and may vary greatly.—MCM

02327 **Hansman, Robert H.; Scott, Harold W.** Catalog of Worthen type and figured specimens at the University of Illinois: Jour. Paleontology, v. 41, no. 4, p. 1013–1028, 1967.

A. H. Worthen was State Geologist of Illinois from 1858 to 1888. The catalog contains 614 species of Paleozoic fossils, predominantly Mississippian and Pennsylvanian from Illinois; the 808 specimens consist of 581 invertebrates, 219 vertebrates, 8 plants.—REG

02038 **Hanson, G. N.; Gast, Paul W.** Kinetic studies in contact metamorphic zones: Geochim. et Cosmochim. Acta, v. 31, no. 7, p. 1119–1153, illus., tables, 1967.

The Duluth Gabbro in Minnesota was intruded 1.05 b.y. ago into the 2.60-b.y.-old Snowbank stock, and a 50-m-thick dolerite dike in the Beartooth Mountains of Wyoming was intruded 800 m.y. ago into gneisses and amphibolites that had been metamorphosed 2.6 b.y. ago. Volume diffusion and zero order and first order chemical reaction rate models are used to describe the rate of loss of radiogenic Sr and Ar from the minerals in the contact zone. It is concluded that the relative stability of mineral ages in a contact zone is hornblende K–Ar>muscovite Rb–

Sr>muscovite K-Ar>biotite Rb-Sr>biotite K-Ar, although for the micas the Rb-Sr and K-Ar ages are essentially concordant. DBV

01986 **Hanzawa, Shoshiro.** Three new Tertiary foraminiferal genera from Florida, Saipan and Guam [with Japanese abs.]: Paleont. Soc. Japan Trans. and Proc., new ser., no. 65, p. 19-25, illus., 1967.

Review of previous works on Tertiary larger Foraminifera from the Gulf of Mexico and Pacific regions has led the writer to establish three new genera. *Quasiborelis* from the lower Eocene of Florida, *Tayamaia* from the Aquitanian of Saipan, and *Quasirotalia* from the Pliocene of Guam. All genera, grouped into a single family Alveolinidae, Albian to Recent in age, vary in external form; their wall structure and mode of growth are similar. The arrangement of the septula, mostly continuous in Mesozoic genera and partly alternating in Cenozoic, may be some clue to phylogenetic relations. *Quasiborelis*, n.gen., is proposed for *Borelis gunter* Cole; *Rotalia atiehensis* (Van der Vleck-Cole) is dealt with as *Quasirotalia guamensis*, n.sp., from the Alifan Limestone; and new genus *Tayamaia* is proposed for *Gypsina marianensis*. GDC

Harakal, J. E. *See* White, William H. 02169

02286 **Harbaugh, John W.** Computer simulation as an experimental tool in geology and paleontology, *in* Essays in paleontology and stratigraphy—R. C. Moore Commemorative Volume: Kansas Univ. Dept. Geology Spec. Pub. 2, p. 368-389, illus., 1967.

Geologic processes and features can be imitated by mathematical simulation with electronic digital computers. A mathematical model for simulating marine sedimentation was developed by Harbaugh (1966) and used to simulate development of Upper Pennsylvanian Plattsburg Limestone, marine banks built by phylloid calcareous algae, in southeastern Kansas. Four main classes of arbitrary units are used, pertaining to: geographic distance; vertical dimension (tectonic and sediment increments); time increments; relative intensity of processes and relative vitality in organism communities. The dynamic model was run according to a set of assumed conditions which were modified until satisfactory results were obtained. Numerical parameters were derived which describe the environmental response of the algae within the model; these parameters will be tested in predicting location and geometry of similar marine banks. VMJ

02237 **Harding, S. R. L.; Garrell, H. A.** Distribution of the Saskatchewan potash beds: Canadian Mining and Metall. Bull., v. 60, no. 662, p. 682-687, 1967.

The potash beds in the Saskatchewan portion of the Williston Basin occur in the upper portion of the Prairie Evaporite formation of the Devonian Elk Point Group. They represent the late stage of a major evaporitic cycle. Two other evaporitic cycles are known in overlying beds, but these apparently never reached the stage of potash salt deposition. The basin in which salt deposition took place extended from the northwestern corner of Alberta southeastward across Saskatchewan into Manitoba, North Dakota and Montana. Deposition of potash salts was apparently restricted to the southeastern portion of the evaporite basin. Authors' abstract

Harris, M. C. *See* Morgan, G. C. 02267

Harrison, William. *See* O'Brien, Neal R. 01940

11221 **Hartley, Thomas G.** The flora of the "Driftless Area": Iowa Univ. Studies Nat. History, v. 21, no. 1, 174 p., illus., 1966.

This study constitutes the first systematic survey of the flora of the "Driftless Area", which covers about 15,000 sq mi in southwestern Wisconsin and adjoining Illinois, Iowa, and Minnesota. Most of the area was apparently never covered by Pleistocene continental glaciations, although there are a few remnants of the older drifts in Minnesota and Iowa. The area served as a refugium for plants during glaciations. The stratigraphy, geomorphology, and glacial geology of the area are summarized. It is concluded that: several plants of the area have disjunct distributions, a few

of which are almost certainly remnants of Pleistocene distributions; there is no strong evidence of pre Pleistocene relics in the area, as no endemic species are known; glaciation of surrounding areas has produced a few habitats that are absent in the Driftless Area, and thus some plants are excluded.—VMJ

Harvey, Richard D. *See* Lamar, J. E. 11181

Hatherton, Trevor. *See* Dickinson, William R. 01974

02273 **Hattin, Donald E.** Stratigraphic and paleoecologic significance of macroinvertebrate fossils in the Dakota Formation (Upper Cretaceous) of Kansas, *in* Essays in paleontology and stratigraphy—R. C. Moore Commemorative Volume: Kansas Univ. Dept. Geology Spec. Pub. 2, p. 570–589, illus., table, 1967.

Seven new fossil localities in north central Kansas have recently yielded at least 40 species of mollusks, mostly pelecypods, from the Dakota Formation. At two localities the fossils are in sandstones deposited in shallow brackish water as parts of a deltaic complex along the margin of the eastwardly transgressing Western Interior Sea. A few fresh-water pelecypods occur with the brackish water forms. At a third locality marine mollusks, only, occur at the top of the Dakota in a sandstone deposited under marine conditions. None of these three assemblages was transported far. Most of the fossils are known only from the Woodbine Formation (Cenomanian) of Texas, indicating that the Western Interior Sea inundated the area between central Kansas and northeastern Texas during deposition of the upper parts of the Dakota and Woodbine.—VMJ

02167 **Haugh, L.; Brisbin, W. C.; Turek, A.** A computer oriented field sheet for structural data: Canadian Jour. Earth Sci., v. 4, no. 4, p. 657–662, illus., 1967.

This computer oriented field data sheet was developed and tested in the field, and has the following characteristics: a standard format designed around a list of principal structural elements; provision for coding structural features and parameters; a format compatible with easy transfer of data to punched cards; and provision for additional descriptive and qualifying notes and sketches. A fold-in copy is included. Although primarily designed for a specific project in the Precambrian Shield, it should be suitable, with minor modifications, for other Precambrian areas.—ESL

01952 **Hawkins, D. B.; Schmalz, B. L.** Environmental tritium studies at the National Reactor Testing Station [summ.], *in* Isotope techniques in the hydrologic cycle Symposium, Univ. Illinois, 1965: Am. Geophys. Union Geophys. Mon. Ser., no. 11, p. 157–158, illus., 1967.

Hay, Ruth J. *See* Ogden, J. Gordon, 3d. 02221

Hay, William W. *See* Sandberg, Philip A. 02339

Hayes, Dennis E. *See* Heirtzler, James R. 02176

02211 **Haynes, C. Vance, Jr.; Grey, Donald C.; Damon, Paul E.; Bennett, Richmond.** Arizona radiocarbon dates VII: Radiocarbon, v. 9, p. 1–14, table, 1967.

C 14 measurements compiled between November 15, 1965 and June 15, 1966 are listed for geochemical samples from Nevada and Arizona; geologic-paleoclimatic samples from Arizona, California, New Mexico, and Malawi; early man-alluvial stratigraphy samples from Arizona, Wyoming, New Mexico, and Colorado; and an archeologic sample from Sudan. An appendix lists corrections to some Arizona VI dates for fractionation during preparation of standard.—MCM

02210 **Hedge, Carl E.** The age of the gneiss at the bottom of the Rocky Mountain Arsenal well: Mtn. Geologist, v. 4, no. 3, p. 115–117, illus., 1967.

The published ages for Precambrian rock cored from the basement at the Rocky Mountain Arsenal well are K-Ar and Rb-Sr ages obtained on biotite. They are undoubtedly younger than the true age of the rock, which is probably about 1.75

b.y. like that of the metamorphosed rocks exposed in the Front Range.—Author's abstract

02079 **Hedges, James A.** On the origin of Clay (Kiel) Cave, California, and some other notable soil pipes [abs.]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 98, 1967.

02081 **Hedges, James A.** Opferkessel on Old Rag Mountain, Madison County, Virginia [abs.]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 99, 1967.

02188 **Hedgpeth, Joel W.** Ecological aspects of the Laguna Madre, a hypersaline estuary, *in* Estuaries (edited by George H. Lauff): Am. Assoc. Adv. Sci. Pub. 83, p. 408–419, illus., tables, 1967.

The Laguna Madre of Texas, formed about 5,000 years ago, is a series of coastal lagoons extending for 120 miles south from Corpus Christi. Separated from the Gulf of Mexico by narrow Padre Island, it is divided into two parts by barren flats between Baffin Bay and Mesquite Rincon. This filling, thought to have occurred within the last century, may be at a node of oscillation in the long narrow lagoon. With no streams of consequence in this arid region, and the lagoon open to the sea only at its extreme ends, salinities in excess of 80 percent were frequent, with abrupt reduction at surface by cloudbursts. Effects of construction of Yarborough Pass opposite Baffin Bay on both biota and sedimentation and the ecosystem approach to the problems are reviewed. Investigations remaining to be done are summarized.—GDC

02176 **Heirtzler, James R.; Hayes, Dennis E.** Magnetic boundaries in the North Atlantic Ocean: Science, v. 157, no. 3785, p. 185–187, illus., 1967.

Magnetic boundaries parallel the continental slope and separate undisturbed from disturbed magnetic regions on both sides of the North Atlantic. The boundaries lie 2,000 to 2,500 km from the axis of the mid-Atlantic ridge and roughly equidistant from it. The undisturbed zone, lying on the continental side of the boundaries, may reflect the long period of no reversals in magnetic polarity that occurred during the late Paleozoic.—Authors' abstract

01955 **Henderson, G.; Pulvertaft, T. C. R.** The stratigraphy and structure of the Precambrian rocks of the Umanak area, West Greenland: Dansk Geol. Foren. Medd., v. 17, no. 1, p. 1–20, illus., geol. map, 1967.

Precambrian rocks of Umanak are divided into a lower, predominantly gneiss group, the Umanak Gneiss, and an upper metasediment group, the Karrat Group subdivided into two formations: the lower comprises quartzites and schists, the upper is a uniform metagreywacke at least 5 km thick. These rocks have been affected by doming, overfolding, and nappe development. Structure contours show some of the important structural features, as doming of the base of the metagreywacke. Rocks of the Umanak Gneiss and the lower Karrat Group have recrystallized under amphibolite facies conditions; the upper Karrat Group may have recrystallized under upper greenschist facies conditions. The Karrat Group may represent infilling of a geosyncline developed on an old gneiss basement, subsequently reactivated.—*from* Authors' abstract

Hernon, Robert M. *See* Jones, William R. 02045

02110 **Herreid, Gordon.** Geology and mineral deposits of the Dolomi area, Prince of Wales Island, Alaska: Alaska Div. Mines and Minerals Geol. Rept. 27, 25 p., illus., tables, geol. map, 1967.

The Dolomi map-area on the east coast of the island is underlain principally by the Silurian(?) Wales group. Devonian(?) andesitic graywacke and slate with minor marble occur in the southwest. The only igneous rocks are scattered post-kinematic mafic dikes. A dome at least three miles long is centered on Paul Lake and is cut by an east-west fault and a major north-south fault system. The fault zones have associated dolomitization, silicification, and mineralized quartz veins. Numerous quartz-tetrahedrite veins with gold and silver were discovered in the area between 1898 and World War I, and some small-scale mining continued until World

War II. Seventy nine stream sediment samples show a scattering of moderate copper, lead, and zinc geochemical anomalies along the fault zone.—LLP

11153 **Heusser, C. J.** Polar hemispheric correlation—Palynological evidence from Chile and the Pacific north west of America. *in* World Climate from 8000 to 0 B. C.—Internat. Symposium, London, 1966, Proc.: London, Royal Meteorol. Soc., p. 124–141, illus. [1966?].

Pollen diagrams and peat stratigraphy of sections from north Pacific America and southern Chile are brought together as a model for comparing late glacial and postglacial climates of temperate latitudes. Thus far, a general parallelism is shown for the climatic trends in these regions; within limits of carbon dating the times of change appear to run in harmony. However, there was contrast in humidity during the late glacial: the early and late zones which were wetter than the middle one in Chile were drier in north Pacific America. The five zones of the postglacial fluctuated both in temperature and humidity.—GDC

02354 **Hewitt, D. F.** Pyrite deposits of Ontario: Ontario Dept. Mines Mineral Resources Circ. 5, 64 p., tables, 1967.

This mineral inventory describes briefly 129 deposits of pyrite in Ontario: 30 in southern Ontario, arranged alphabetically by counties, 99 in northern Ontario, alphabetically by district and by property name. The Goudreau deposits are described as a group at the end of the District of Algoma group. The only commercial production of pyrite or pyrrhotite in Ontario at present is from the Sudbury mines. It seems possible that with the increased demand for pyrite some of the mines will be reactivated; some base metal mines may find it profitable to recover pyrite and pyrrhotite from the ores.—GDC

02366 **Hilker, R. G.** The Whitehorse copperbelt: Western Miner, v. 40, no. 7, p. 37–46, 1967.

The Whitehorse copperbelt is on the west side of the Whitehorse trough in southwestern Yukon. Barite and chalcopyrite occur along a belt 18 miles long in the Lewes River Group of metamorphosed sedimentary rocks of Upper Triassic age. Calcium–magnesium–silicate and calcium–magnesium–iron skarns were formed where the sediments were intruded by a large batholith of Cretaceous age. Copper–iron mineralization is in skarn. Reserves in five deposits are 5 1/2 million tons of 1.25 percent copper with some molybdenum and one dollar and thirteen cents in gold and silver, and 3 1/2 million tons of 2.14 percent copper.—ARK

02229 **Hill, D. P.; Pakiser, L. C.** Seismic–refraction study of crustal structure between the Nevada Test Site and Boise, Idaho: Geol. Soc. America Bull., v. 78, no. 6, p. 685–704, illus., tables, 1967.

The crust in the northern Basin and Range province consists of a 6.0–kmps layer 19–24 km thick above a 6.7–kmps layer 10–12 km thick. The crust in the western Snake River Plain consists of a 5.2–kmps layer 8–10 km thick over a 6.7–kmps layer 33–38 km thick. The P–velocity in the upper mantle along the profile is 7.9 kmps.—AG

01964 **Hill, Thelma P.; Werner, Marian A.; Horton, M. Julia.** (compilers). Chemical composition of sedimentary rocks in Colorado, Kansas, Montana, Nebraska, North Dakota, South Dakota, and Wyoming: U.S. Geol. Survey Prof. Paper 561, 241 p., illus., tables, 1967.

This report is a compilation of 2,842 published chemical analyses of sedimentary rocks of the northern Great Plains and Rocky Mountains areas. Additional information such as spectrographic analysis, location, rock description, age, and formation, and use of each rock sample is given if reported in the original publication. The analyses are grouped by means of a classification system which is based on amounts of uncombined silica, clay, and calcium–magnesium carbonate. The composition of analyzed rocks is summarized by triangular diagrams and cumulative curves, and the geographic and stratigraphic distribution of the analyzed rocks is shown on maps.—TPH

02299 **Hills, L. V.; Baadsgaard, H.** Potassium–argon dating of some lower Tertiary strata in British Columbia: Bull. Canadian Petroleum Geology, v. 15, no. 2, p. 138–149, illus., table, 1967.

Twenty K–Ar dates were determined on biotite, sanidine, plagioclase, hornblende and glass shards separated from volcanic rocks at eight localities. Fifteen dates fall within the range 47 to 52 m.y., confirming the middle Eocene age obtained for the strata by Rouse and Mathews (1961). A 21 m.y. date yielded by a single sample of glass shards is low because of the susceptibility of glass to argon loss. Dates of 56 to 126 m.y. from the remaining samples probably reflect contamination by reworked older rock fragments. Samples of plagioclase and hornblende yield dates in agreement with other data and thus are useful in dating materials where sanidine or biotite is not available. Multiple mineral separates, sample purity, and lack of contamination are necessary requisites for reliable dates.—*from* Authors' abstract

Himmelberg, Glen. *See* Barnes, Ivan. 01962

02006 **Hinman, Eugene E.** Fossil collecting in the Davenport area: Earth Sci., v. 20, no. 4, p. 173, 1967.

A list of fossils that may be collected from Devonian strata in three quarries in the Davenport, Iowa, area is given, with a brief description of the stratigraphy.—ESL

02073 **Hinrichs, E. Neal; Krushensky, R. D.; Luft, S. J.** Geologic map of the Ammonia Tanks quadrangle, Nye County, Nevada: U.S. Geol. Survey Geol. Quad. Map GQ–638, scale 1:24,000, sections, 1967.

Hoar, Florence Grosvenor. *See* Waines, Russell H. 01954

02030 **Hobson, R. D.** FORTRAN IV programs to determine surface roughness in topography for the CDC 3400 computer: Kansas Geol. Survey Computer Contr. 14, 28 p., illus., tables, 1967.

Current uses of remote sensing apparatus for geologic investigation place new demands upon types of information gathered by the field geologist. One new area of field investigation is surface roughness. This paper presents several quantitative parameters for describing three aspects of surface roughness: (1) comparison of surface areas, (2) frequency distribution of surface irregularities, and (3) orientation of normals to surfaces. Mathematical methodologies for computing parameters are described. Three CDC 3400 FORTRAN IV programs for computing parameters are listed along with detailed operating instructions. Data obtained from the NASA Pisgah Crater Test Site in California are used to illustrate typical uses of surface roughness parameters.—Author's abstract

02185 **Hoffman, Paul.** Algal stromatolites—Use in stratigraphic correlation and paleocurrent determination: Science, v. 157, no. 3792, p. 1043–1045, illus., 1967.

Algal stromatolites are used for detailed rock-stratigraphic correlation for a distance of 160 kilometers in the Pethei Formation, of Aphebian (Precambrian) age, in the Northwest Territories, Canada. Laterally linked stromatolites are initiated by the draping of successive laminations over intraclasts or other irregularities in the bedding surface. Stromatolite shapes and orientations are related to paleocurrent direction determined from associated sedimentary structures. Thus stromatolite geometry is at least in part environmentally controlled.—Author's abstract

02126 **Hoffmann, Robert S.; Peterson, Richard S.** Systematics and zoogeography of *Sorex* in the Bering Strait area: Systematic Zoology, v. 16, no. 2, p. 127–136, illus., table, 1967.

Shrew populations on the islands in the Bering Strait region (*Sorex pribilofensis, S. jacksoni, S. hydrodromus*) were regarded as related to *Sorex arcticus* of the Alaskan mainland. Our data indicate that *S. pribilofensis and S. jacksoni* are members of the *S. (Otiosorex) cinereus* group, which occurs both in Alaska and

eastern Siberia. *Sorex hydrodromus* apparently does not exist on Unalaska Island, and is a synonym of *S. pribilofensis*. The Holarctic evolution of the *S. cinereus and S. arcticus—S. araneus* groups, and their occurrence on the Bering land connection in the late Pleistocene, is discussed.—Authors' abstract

02378 **Holman, J. Alan.** A Pleistocene herpetofauna from Ladds, Georgia: Georgia Acad. Sci. Bull., v. 25, no. 3, p. 154–166, illus., table, 1967.

The Ladds Pleistocene fauna includes nine amphibians and 15 reptiles, of which six and 13 are identifiable to species; these are described or annotated briefly. Occurrence together of *Anolis carolinensis and Clemmys insculpta* suggests a heterochronic assemblage at least in part. Today the anole ranges north only to extreme southeastern Virginia and the wood turtle ranges south only to northernmost Virginia. Nevertheless, all species of the Pleistocene herpetofauna except the wood turtle can be found living in or near the Ladds area today. Based on preferences of the living forms, these ecological situations were present: moist deciduous woodland; open woodland or brushy edge; swift, clear stream; large woodland pool. The huge *Bufo americanus* is noteworthy; apparent gigantism in Pleistocene amphibians has not yet been explained satisfactorily.—VMJ

02092 **Holsinger, John R.** A summary of eight years of exploration in the caves and karst of southwestern Virginia [abs.]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 109–110, 1967.

02130 **Horton, C. W.** The electrical conductivity of the Earth's mantle, *in* Magnetism and the cosmos—NATO Advanced Study Inst. Planetary and Stellar Magnetism, Univ. Newcastle upon Tyne, 1965: New York, American Elsevier Publishing Co., p. 126–140, illus., 1967.

A major transition takes place in the electrical thermal, and elastic properties of the Earth in the first 1,000 km. Values of electrical conductivity are much better known than of temperature, and direct experimental data are available down to 500 km from studies of the behavior of the magnetotelluric field. The dependence of conductivity on temperature and pressure is discussed and the comparatively recent technique of magnetotelluric sounding to determine values of conductivity in the mantle is described and general interpretations to date summarized.—VSN

Horton, M. Julia. *See* Hill, Thelma P. 01964

02002 **Horvath, Allan L.** Horace Noble Coryell (1888–1965): Am. Assoc. Petroleum Geologists Bull., v. 51, no. 7, p. 1369–1371, portrait, 1967.

11166 **Hovsepian, Dickran Y.** General inventory of physical resources from existing data, *in* United Nations Regional Cartographic Conf. for Asia and Far East, 4th, Manila, 1964—V. 2, Proc. and Tech. Papers: New York, United Nations, p. 480–481, 1966.

National plans for social and economic improvement challenge the best efforts of public officials and others, including geologists, soil scientists and workers in related disciplines. The body of data required in the general planning stage, called here the General Inventory of Physical Resources, includes surface configuration, soils, geology, rock types, drainage, mineral and water resources, suitability for road construction, geodesy, aerial photography, and construction materials. Its design involves minimum use of graphic colors; tabular as well as graphic data in loose-leaf form, easy to revise and augment; easy comparison and correlation of one subject with another; ready reproduction of small or large quantities of one or more subjects, or the entire GIPR. The package is currently used in Latin American countries under the U.S. Agency for International Development.—GDC

02084 **Howard, Alan D.; Ellis, Barbara Y.** Solution of limestone under laminar flow between parallel boundaries [abs.]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 104, 1967.

02085 **Howard, Alan D.** Stratigraphic and structural controls on landform development in the karst area of central Kentucky [abs.]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 104–105, 1967.

01987 **Howard, Ephraim Manesseh.** Application of the Mössbauer effect in determination of phase diagrams: California Univ., Livermore, Radiation Lab. Rept. UCRL–50262, 82 p., illus., 1967.

The use of the Mössbauer effect in the determination of the phase diagram for Ni–Au is evaluated. The Ni–Au phase diagram obtained with Mössbauer data from two–phase specimens and the calibration curve made from one phase data was in good agreement with X–ray diffraction measurements and the existing Ni–Au diagram. It is shown that the solid phase boundary for Ni–Au could be determined using the magnetic properties as well as the isomer shift. Extension of this approach to other systems may be based on these or other Mössbauer parameters. In each case, the parameters to be used would be determined from studies of Mössbauer spectra across the alloy composition range.—LLP

02393 **Howe, Herbert J.** Rhynchonellacea from the Montoya Group (Ordovician) of Trans–Pecos Texas: Jour. Paleontology, v. 41, no. 4, p. 845–860, illus., tables, 1967.

Hypsiptycha argenturbicum (White), *H. neenah* (Whitfield), *Lepidocyclus? capax* (Conrad), *L. manniensis* (Foerste), *L. laddi* Wang, *Rhynchotrema iowense* Wang and an unnamed species of *Lepidocyclus* Wang are described from the Montoya Group (Trentonian? and Cincinnatian) of west Texas and southern New Mexico. A comparison of the Montoya brachiopod species with those found in the Maquoketa Shale (Cincinnatian) of Iowa demonstrates very strong affinity between these two faunas.—Author's abstract

02385 **Hsu, K. Jinghwa.** Chemistry of dolomite formation, Chap. 4 *in* Developments in sedimentology—[V.] 9B, Carbonate rocks—Physical and chemical aspects: Amsterdam and New York, Elsevier Publishing Co., p. 169–191, illus., tables, 1967.

Chemical experiments under atmospheric conditions have not yielded any unequivocal answers on the stability of dolomite. The possibility exists that the stability of dolomite in the system $CaCO_3$—$MgCO_3$—CO_2—H_2O at 25°C and 1 atm is related not only to temperature and pressure but also to the partial pressure of CO_2. The common occurrence of dolomite in ancient carbonate rocks indicates that dolomite rather than a mineral pair is the stable phase under the low temperature and pressure conditions of carbonate diagenesis. Experimental results on the solubility of dolomite and on the composition of solutions at a dolomite–calcite–solution equilibrium are controversial, but suggest that the K_d value is less than 1 at room temperatures and atmospheric and near–surface pressures. *from* Author's abstract

02034 **Huang, Ter–Chien; Goodell, H. G.** Sediments of Charlotte Harbor, southwestern Florida: Jour. Sed. Petrology, v. 37, no. 2, p. 449–474, illus., tables, 1967.

Grab samples and shallow cores from the Charlotte Harbor system, southwestern Florida, show that the sediments are relatively uniform in character throughout the harbor system. They consist mainly of terrigenous quartz sand, inherited from adjacent rocks and reflecting relative availability, and biogenic carbonate materials; minor components are phosphorite, kaolinite, montmorillonite, attapulgite, and illite. Mean grain size of sediments and percentage of carbonate detritals increase seaward. Coarse sediments accumulate in high energy areas at the harbor mouth and in channels. Sediments are shifted by the two major tidal circulations of the harbor proper and of San Carlos Bay. Multivariate nonlinear regression is used to relate sediment characteristics to provenance, transportation, and depositional environments. Expected post lithification features are listed. *from* Authors' abstract

02219 **Hubbs, Carl L.; Bien, George S.** La Jolla natural radiocarbon measurements V: Radiocarbon, v. 9, p. 261–294, tables, 1967.

The 154 measurements reported run from December 1964 to November 1966. Categories and localities of samples are: (1) apparent age of contemporary organisms; (2) sealevel changes and shore processes—Alaska, California, west coast of Mexico, Juan Fernandez Islands (Chile), South Seas, Australia, and east coast of South America; (3) ocean sediments—southern California, Gulf of Panama, east Pacific deep-sea, Indonesia and Australia, and Adriatic Sea; (4) ancient and modern lakes—California, Baja California, and Nevada; (5) geochemical processes—California and South Australia; and (6) archeology—Wyoming, California, Mexico, Peru, and Quebec.—MCM

02059 **Huber, N. King; Rinehart, C. Dean.** Cenozoic volcanic rocks of the Devils Postpile quadrangle, eastern Sierra Nevada, California: U.S. Geol. Survey Prof. Paper 554-D, p. D1-D19, illus., tables, geol. map, 1967.

Cenozoic volcanic rocks of the Devils Postpile quadrangle are of late Pliocene to Recent age and are divided into 11 map units. The suite is alkalic-calcic and ranges in composition from basalt to rhyolite. It includes a rhyolitic welded ash-flow tuff which is probably correlative with the Bishop Tuff, although the two units are geographically isolated by the Sierra Nevada drainage divide. The Devils Postpile itself is a classic example of columnar jointing in the lower part of a lava flow.—Authors' abstract

02232 **Hubert, John F.; Neal, William J.** Mineral composition and dispersal patterns of deep-sea sands in the western North Atlantic petrologic province: Geol. Soc. America Bull., v. 78, no. 6, p. 749-771, illus., tables, 1967.

A petrologic province of terrigenous derived marine sands of Wisconsin and post-Wisconsin age is defined for the western North Atlantic. The province is subdivided on the basis of variations in light minerals into a western subprovince, characterized by glauconitic quartzose sands derived by sorting and abrasion of arkosic glacial detritus on the shelf, and an eastern subprovince characterized by arkosic sands unmodified by southward transport from a northern source. The western light mineral subprovince is further divided into four parts by variations in heavy mineral assemblage; a fifth heavy mineral division corresponds to the eastern light mineral subdivision.—RGY

02363 **Hulings, Neil C.** A review of the Recent marine podocopid and platycopid ostracods of the Gulf of Mexico: Contr. Marine Sci., v. 12, p. 80-100, illus., table, 1967.

Taxonomic, ecological and other studies on Gulf of Mexico ostracods are discussed and summarized. The salinity, temperature, depth, ranges, sediment type and environment for most named Recent species reported from the Gulf are given.—Author's abstract

02183 **Hunt, John M.** The origin of petroleum in carbonate rocks, Chap. 7 *in* Developments in sedimentology—[V.] 9B, Carbonate rocks—Physical and chemical aspects: Amsterdam and New York, Elsevier Publishing Co., p. 225-251, illus., tables, 1967.

The hydrocarbons in petroleum appear to owe their origin to different sources and mechanisms. The light hydrocarbons and gases are formed in sediments from the decomposition of heavier organic materials, and the heavier hydrocarbons are synthesized by living organisms and are formed in the sediments. Formation of hydrocarbons appears to continue until the sediments are so metamorphosed that only methane is obtained. Carbonate sediments appear to be as effective source beds as clay sediments and the process of oil accumulation is more efficient in carbonates than in sand-shale sequences. Carbonates, however, have very little catalytic activity compared to clays. The fact that 40 percent of the petroleum in major oil fields is in carbonate reservoirs indicates that carbonates can be oil source beds.—*from* Author's abstract

02337 **Hunter, R. E.** The petrography of some Illinois Pleistocene and Recent sands: Sed. Geology, v. 1, no. 1, p. 57-75, illus., tables, 1967.

Some Recent and Pleistocene sands of Illinois and the nearby Missouri River were separated petrographically into three groups reflecting source material. Those from glacial material of Illinois and the upper Mississippi, Wabash, and Lake Michigan drainage basins contain types of feldspars and rock fragments derived from Precambrian metamorphic rocks of the Canadian Shield. In Ohio River sands at the southern boundary of Illinois, there are many polycrystalline quartz and nonfeldspathic rock fragments from Paleozoic sedimentary rocks of Appalachian derivation and from glacial drift of the eastern states. Sands of the Missouri River and below its mouth in the Mississippi River consist of feldspars and rock fragments, especially volcanic, derived from Cretaceous and Tertiary igneous rocks of the western United States. The variation in composition with changing grain size was taken into account.—GDC

02021 **Hunter, Ralph E.** A rapid method for determining weight percentages of unsieved heavy minerals: Jour. Sed. Petrology, v. 37, no. 2, p. 521–529, illus., tables, 1967.

Proportions by weight of specific or total heavy minerals in the various particle size classes of a sediment may be determined by point counting a slide mount of the unsieved heavies. Weights are determined by a formula containing specific gravity, cubed grain diameters, and number of grains, as the variables. The proposed method sacrifices some statistical certainty, but saves time over the method of making grain counts of sieved fractions.—RAC

02043 **Hurley, P. M.; deAlmeida, F. F. M.; Melcher, G. C.; Cordani, U. G.; Rand, J. R.; Kawashita, K.; Vandoros, P.; Pinson, W. H., Jr; Fairbairn, H. W.** Test of continental drift by comparison of radiometric ages: Science, v. 157, no. 3788, p. 495–500, illus., 1967.

The distribution of K-Ar and Rb-Sr ages appears almost identical for the West African rocks of the Eburnean orogenic cycle and basement rocks at opposite locations in South Africa. There is also close correlation between rocks of the Pan-African cycle and Caririan cycle in Brazil, where they lie opposite each other. When Africa and South American are fitted together, the boundary between the Eburnean and the Pan-African age provinces strikes directly toward the corresponding boundary in Brazil. The transition from the 550-m.y. Pan-African province to the 2,000-m.y. age province in the Congo Craton is matched on the east coast of Brazil. This evidence supports continental drift.—DBV

Hurley, P. M. *See* Powell, J. L. 11128

02355 **Huskey, William L.; Crawford, Paul B.** Performance of petroleum reservoirs containing vertical fractures in the matrix: Soc. Petroleum Engineers Jour., v. 7, no. 2, p. 221–228, illus., 1967.

A study has been made to determine the effects of random vertical fractures existing in a reservoir matrix on the effective matrix properties and producing characteristics of a well. The study indicates that short vertical fractures may distort the isopotentials by one percent in the vicinity of the fracture. A correlation was developed which indicated that fracture shape had little effect on producing capacity, but that total fracture length was closely correlated with the producing capacity. Effective values of reservoir permeability were found to correlate closely with fracture density when measured parallel to the direction of flow.—*from* Authors' abstract

Iglehart, C. F. *See* Forgotson, J. M., Jr. 01995

11198 **Indiana Geological Survey; Indiana University Dept. Geology.** A symposium on geology of cement raw materials: Forum on geology of industrial minerals, 2d, 1966, Proc.: Bloomington, Ind., Indiana Geol. Survey and Indiana Univ., 197 p., illus., tables [1966?].

The subject for the forum was chosen because large surface deposits meeting high specifications are becoming difficult to find near areas of large consumption, so that knowledge of the geology becomes more and more essential to discovery and development of new reserves. Of the 17 papers presented, 16 are published here:

subjects include geology of raw materials in five midwestern states, chemical variation and radioactivity in cement and aggregate materials, and geophysical exploration methods.—ESL

Indiana University Dept. Geology. *See* Indiana Geological Survey. 11198

02289 **Ireland, H. Andrew.** Zonation and correlation of the subsurface Hunton Group (Silurian–Devonian) in Kansas by Foraminifera and acid residues. *in* Essays in paleontology and stratigraphy—R. C. Moore Commemorative Volume: Kansas Univ. Dept. Geology Spec. Pub. 2, p. 479–502, illus., tables, 1967.

The Hunton Group, a sequence of carbonate beds between the Maquoketa Formation and the Chattanooga Shale in the subsurface of Kansas, was divided by W. Lee (1943, 1956) into five Silurian and two Devonian zones on the basis of lithology and acid residues. Ireland (1966) found arenaceous Foraminifera in Lee's Silurian Zone 3, which made correlation possible with the Clarita Member of the Chimney Formation in southern Oklahoma and time equivalents in Missouri and Illinois. In the present study, cores from 54 wells in northeastern Kansas were examined for lithology, acid residues, and Foraminifera. Lee's subdivisions were confirmed; although microfossils were found only in Silurian Zone 3, correlations based on stratigraphic positions and acid-residue content are suggested for the other zones. Faults, responsible for abnormal thicknesses, were detected.—VMJ

11140 **Irwin, Joseph S.** Thomas Bowerman Williams, 1884–1966: Bull. Canadian Petroleum Geology, v. 14, no. 4, p. 627–628, 1966.

02226 **Ives, Patricia C.; Levin, Betsy; Oman, Charles L.; Rubin, Meyer.** U.S. Geological Survey radiocarbon dates IX: Radiocarbon, v. 9, p. 505–529, 1967.

This list contains the results of measurements made during 1965 and 1966 on samples from numerous localities in the United States, from Alaska, the Atlantic Ocean, Chile, Costa Rica, Hawaii, Israel, and Malaysia.—MCM

01930 **Jacobson, Norman; Anderson, Jay.** Summer institute in field ecology and field geology for high school students [summ.]: Montana Acad. Sci. Proc. 1966, v. 26, p. 95–98, 1967.

02277 **Jambor, J. L.; Potter, R. R.** Rubidium-bearing dykes, Gods River area, Manitoba: Canada Geol. Survey Paper 67-15, 7 p., illus., tables, 1967.

Dikes at Red Cross Lake in the Gods River area of Manitoba contain purple mica which contains 3.08 percent Li_2O, 4.53 percent Rb_2O, and 1.00 percent Cs_2O. Whole rock chemical analyses of 5 grab samples from a dike swarm average over 1.2 percent Li_2O and 1.0 percent Rb_2O. Most of the lithium and rubidium are bound in muscovite, lepidolite, and amblygonite.—Authors' abstract

01994 **James, William R.** Nonlinear models for trend analysis in geology, *in* Computer applications in the earth sciences—Colloquium on trend analysis: Kansas Geol. Survey Computer Contr. 12, p. 26–30, illus., 1967.

The standard techniques of trend-surface analysis involve regression of mathematical functions which are linear with respect to their coefficients. The regional variability of many mapped variables is such that standard models are basically inadequate, and in many cases complicate the otherwise simple regional picture. The geologist often has some basic idea of some underlying geometric form which may be expressed in general mathematical terms. This "substantive" geometric model may be regressed and residuals plotted. The analysis of residuals may well lead to a revision of the original model and a new one developed and regressed. Through this iterative procedure a satisfactory "trend" may be found and meaningful "fit" parameters might be discovered.—*from* Author's abstract

Jarosewich, Eugene. *See* Mason, Brian. 02056

02343 **Jarosewich, Eugene.** Chemical analyses of seven stony meteorites and one iron with silicate inclusions: Geochim. et Cosmochim. Acta, v. 31, no. 6, p. 1103–1106, tables, 1967.

A group of stony meteorites: Bununu, Cumberland Falls (Black Chondrite Inclusion), Forest Vale, Goodland, Grady (1937), Leedey, Mezö-Madaras, and one silicate-rich iron meteorite, Woodbine, have been chemically analyzed. The results of these analyses are presented in this paper.—Author's abstract

02112 **Jasper, Martin W.** Geochemical investigations, Willow Creek southerly to Kenai Lake region, south central Alaska: Alaska Div. Mines and Minerals Geochem. Rept. 14, 47 p., illus., table, 1967.

The 1966 geochemical investigations did not disclose any strong anomalies or radioactivity in the 113 stream samples taken. Seven samples had moderately anomalous amounts of copper, two of lead, 22 of zinc, and 15 of molybdenum. Streams having anomalies of more than 120 ppm copper, 30 ppm lead, 160 ppm zinc, or 8 ppm molybdenum should be considered for sampling upstream. Placer gold deposits in the Resurrection Creek, Mills Creek, and Sunrise areas have had substantial production. Gold-quartz discoveries have not been economic on the Kenai Peninsula, but have been productive in the Willow Creek and upper Little Susitna River district. No valuable base metal deposits have been found on the Kenai Peninsula. Low-grade copper occurrences in the Willow Creek district, and a low-grade copper-molybdenum prospect near Reed Creek are known.—LLP

02119 **Jasper, Martin W.** Geochemical investigations along the Valdez to Chitina Highway in southcentral Alaska, 1966: Alaska Div. Mines and Minerals Geochem. Rept. 15, 31 p., illus., table, 1967.

Results of stream sediment sampling, 102 samples, along 120 mi of highway revealed no outstanding anomalies. Renewed interest has been shown in the chromite area on Red Mtn. and copper occurrences along the Copper River in the Chitina area.—*from* Author's summary

02276 **Jeletzky, J. A.** Jurassic and (?)Triassic rocks of the eastern slope of Richardson Mountains, northwestern District of Mackenzie: Canada Geol. Survey Paper 66-50, 171 p., illus., 1967.

Triassic(?) rocks in this area are found only in the Rat River Gorge and adjacent parts of the Aklavik Range. A thick conglomerate and sandstone unit below the coaly shale division is named Brat Creek Formation; palynology suggests a Triassic age. The Jurassic is characterized by thin and incomplete development, largely shallow-water marine to nonmarine facies, and is replaced westward and northward by deep-water shales. The sandy lower part is named Bug Creek Formation; a disconformity within it indicates uplift of the Aklavik arch. The shaly upper part, the Husky Formation, includes the basal Cretaceous; southward the Husky is replaced by coarse clastics of the North Branch Formation. An appendix contains 25 measured sections.—ESL

11143 **Jelgersma, S.** Sea-level changes during the last 10,000 years, *in* World Climate from 8000 to 0 B. C.—Internat. Symposium, London, 1966, Proc.: London, Royal Meteorol. Soc., p. 54–71, illus. [1966?].

The results of various studies of postglacial and sea-level changes are evaluated. There is some agreement on early Holocene movements, but those of the last 5,000 years are much disputed. Three different opinions on the movements of eustatic sea-level are held: an oscillating, a steady, and a rising sea-level. At present the latter concept seems most likely. Evidence for high postglacial sea-level stages are questionable. The Holocene sequence in the Netherlands region is compared with dated sections from the Gulf Coast. The cyclicity in coastal deposits shows the effect of a succession of wet and dry climatic conditions.—GDC

01985 **Jenness, S. E.** (editor). Report of activities—Pt. A, May to October, 1966: Canada Geol. Survey Paper 67-1, pt. A, 221 p., illus., tables, 1967.

This report presents 138 brief papers on field work undertaken in 1966 by members of the Geological Survey of Canada, and 16 additional statements on mineralogical, paleontological, and palynological collecting projects.—Author's abstract

01933 **Jepsen, Glenn L.** Notable geobiologic moments: Geotimes, v. 12, no. 6, p. 16–18, illus., 1967.

Two fossils found in the Eocene varves of the Green River Formation in Fossil Lake, southwestern Wyoming, are described. One, the oldest known flying mammal, a microbat with talons on the index fingers, has been named *Icaronycteris index*. The other fossil is of a perch which tried to swallow a smaller herring and died with the herring plugging its mouth.—ESL

01913 **Jerome, S. E.; Cook, D. R.** Relation of some metal mining districts in the western United States to regional tectonic environments and igneous activity: Nevada Bur. Mines Bull. 69, 35 p., illus., 1967.

Comparison of metallization maps with geologic and tectonic, shows the close correspondence of western mining districts to igneous centers and the importance of zones of structural weakness. No preferred localization of mining districts in shield, shelf, basin, or geosyncline is observed. The common denominator of most western districts seems to be a dynamic situation in which the classical sequence of folding, faulting, intrusion, faulting or brecciation, and mineralization can be recognized. Repeated faulting infers maintenance of openings in deeply penetrating plumbing systems. The fundamental controls often give rise to striking regional alignments; some examples in Arizona, New Mexico, and Nevada are discussed briefly. The environmental maps reaffirm the generally decreasing age from west to east, of intrusives and metals.—ESL

02008 **Johannesen, Richard.** Fossils of the Mississippi Valley: Earth Sci., v. 20, no. 4, p. 158–162, illus., 1967.

Fossils that can be collected along the Mississippi Valley in Iowa and Illinois are listed by community and 12 are illustrated.—ESL

02010 **Johnson, Elden.** Prehistory in our state parks: Conserv. Volunteer, v. 30, no. 173, p. 13–17, illus., 1967.

Prehistoric archeological sites are known from every county in Minnesota, a number lying within the new Mille Lacs–Kathio State Park. One of these, Petago Point, shows two major occupations—early hunters and later rice-harvesting people. Stone and copper artifacts mark the earlier site. Two other sites are described briefly, one which may mark the beginning of the use of rice as food, and the other, a large permanent village.—ESL

11188 **Johnson, H. Cyril.** Western gem hunters atlas—Rock locations from California to the Dakotas and British Columbia to Texas (7th edition, revised): Susanville, Calif., Cy Johnson Books–Rockcraft, 95 p., illus., 1966.

Mineral and gem locations in the western United States and British Columbia are shown on detailed maps. Also included are types of material to be found, mileages, and mineral shop locations.—LLP

Johnson, J. G. *See* Amsden, T. W. 02392

02394 **Johnson, J. G.; Boucot, A. J.** *Gracianella*, a new Late Silurian genus of atrypoid brachiopods: Jour. Paleontology, v. 41, no. 4, p. 868–873, illus., 1967.

Gracianella n. gen. is proposed for small forms, allied to *Atrypina* of the subfamily Atrypininae, that have identical interior structures but vary from completely smooth to prominently costate specimens. It includes *Retzia umbra* (de Regny), widespread in beds of Ludlow and Pridoli age in central Europe, and three new species, *G. lissumbra* (type species), *G. plicumbra*, and *G. crista*, which are abundant in the Roberts Mountains Formation of the same age in central Nevada.—REG

02395 **Johnson, J. G.** *Toquimaella*, a new genus of karpinskiinid brachiopod: Jour. Paleontology, v. 41, no. 4, p. 874–880, illus., 1967.

Toquimaella is proposed as a new atrypoid genus closely related in internal structure to *Vagrania* Alekseeva. Members of both genera have a pair of long vascular ridges (new term) in the pedicle valve, a structure which in other atrypoids is noted only in *Eokarpinskia* Rzhonsnitskaya and *Karpinskia* Tschernyschew. *Toquimaella kayi* n.sp., from beds of early Siegenian [Lower Devonian] age in central Nevada and in Arctic Canada, is proposed as type species. It is transitional morphologically between *Vagrania and Karpinskia* and thus supports the view that the subfamily Karpinskiinae includes *Eokarpinskia, Karpinskia, Toquimaella, and Vagrania. Nalivkinia* Bublitschenko and *Mimatrypa* Struve are rejected from the subfamily Karpinskiinae.—*from* Author's abstract

02404 **Johnson, J. G.; Talent, John A.** Cortezorthinae, a new subfamily of Siluro Devonian dalmanellid brachiopods: Palaeontology, v. 10, pt. 1, p. 142–170, illus., 1967.

Cortezorthinae is proposed to include the Lower to Middle Devonian septate dalmanellid *Cortezorthis* n.gen. (*C. maclareni* n.sp., type species), its Silurian to Lower Devonian aseptate precursor *Protocortezorthis* n.gen. (*"Dalmanella" fornicatimcurvata*, type species), and their Devonian derivatives *Reeftonia and Cariniferella*. New species are *P. windmillensis and C. cortezensis* from Nevada and *C. maclareni and C. bathurstensis* from Ellesmere and Bathurst Islands, N.W.T. Cortezorthinae evolved from Isorthis: the Silurian *Protocortezorthis* developed distinctive ventral musculature reminiscent of rhipidomellids. Devonian genera evolved away from the isorthoid muscle pattern toward rhipidomellid internal morphology. *P. windmillensis* is intermediate between fully differentiated *Protocortezorthis and Cortezorthis* species.—VMJ

02409 **Johnson, J. G.** Systematic position of the genus *Irboskites* (Brachiopoda): Jour. Paleontology, v. 41, no. 4, p. 1003–1004, 1967.

The author agrees with Nalivkin (1941) that this Devonian Russian genus is a strophalosiid productoid, not a strophomenoid of the superfamily Davidsoniacea, subfamily Streptorhynchinae as tentatively classified by A. Williams (1965, Treatise on invertebrate paleontology, Pt. H, p. H409).—REG

02045 **Jones, William R.; Hernon, Robert M.; Moore, Samuel L.** General geology of Santa Rita quadrangle, Grant County, New Mexico: U.S. Geol. Survey Prof. Paper 555, 144 p., illus., tables, geol. maps, 1967.

The Santa Rita quadrangle lies on the northeast limb of a broad, northwest trending, internally faulted, synclinal horst block containing about 2,800 feet of Paleozoic rocks, dominantly limestone and dolomite, and 1,000–2,000 feet of Mesozoic rocks, dominantly shale and sandstone. The ends of the horst are mantled by volcanic rocks of Miocene(?) age. During the Late Cretaceous and Tertiary, about 25 distinguishable varieties of igneous rocks were emplaced in a variety of forms assignable to a definite chronological order: sills and laccoliths first, andesite breccia and mafic porphyry dike swarms, three stocks (one is the site of the Chino open-pit copper mine), and dikes and small plugs last. Widespread ore mineralization intervened between intrusion of granodiorite porphyry and quartz monzonite porphyry dikes.—WPP

02297 **Kaesler, Roger L.** Numerical taxonomy in invertebrate paleontology, *in* Essays in paleontology and stratigraphy—R. C. Moore Commemorative Volume: Kansas Univ. Dept. Geology Spec. Pub. 2, p. 63–81, 1967.

Numerical taxonomy is leading to a re-evaluation of the principles of systematics. The insistence on operational definitions has resulted in widespread acceptance of the concept of operational homology and of a phenetic rather than a phylogenetic basis for classification. Paleontologists have been little affected by the revolution in neontologic systematics, partly because the biological species concept is hardly applicable to fossils. But numerical taxonomy can do much for paleontology by providing a firm conceptual framework free of the inconsistencies of the new

systematics. In turn, paleontologists can contribute to numerical taxonomy their experience in dealing with chronistic taxonomic relationships. Many problems in applying numerical taxonomy to paleontology arise from the different patterns of growth in invertebrate groups; these are discussed and some solutions are suggested.—VMJ

02399 **Kane, Henry E.** Recent microfaunal biofacies in Sabine Lake and environs, Texas and Louisiana: Jour. Paleontology, v. 41, no. 4, p. 947–964, illus., tables, 1967.

Two Recent biofacies based on foraminifera are dominant in the bottom sediments of a lake estuary environment, Sabine Lake, in Texas and Louisiana; another biofacies is present in the bottom sediments of the southern portion of the lake near the head of Sabine Pass; and another in the bottom sediments of the adjacent nearshore neritic environment of northwestern Gulf of Mexico. The two environments can be differentiated by the biofacies *Haplophragmoides–Miliammina and Ammobaculites* in Sabine Lake and by the biofacies *Miliolidae* in the Gulf of Mexico and *Streblus–Elphidium* near the head of Sabine Pass. Differences in the water salinities of the two environments are considered the major ecological factor controlling distribution of the biofacies.—*from* Author's abstract

01911 **Karabatsos, George T.** South Borosa Field, Starr County, Texas, *in* Typical oil and gas fields of south Texas: Corpus Christi, Tex., Corpus Christi Geol. Soc., p. 182–187, illus., tables, 1967.

11156 **Karo, H. Arnold.** Emergency charting of the Alaska earthquake disaster area, *in* United Nations Regional Cartographic Conf. for Asia and Far East, 4th, Manila, 1964—V. 2, Proc. and Tech. Papers: New York, United Nations, p. 173–182, illus., 1966.

It is estimated that the Good Friday earthquake of 1964 released twice as much energy as the 1906 earthquake that devastated San Francisco. Plans were made and orders given for immediate resurvey of the damaged areas in the Anchorage region to ensure safety of transportation, necessary corrections for map and chart coverage, and re establishment of geodetic control for reconstruction, and other engineering projects. Immediate and long-range plans were put into effect to monitor aftershocks, obtain strong motion seismic data, study damage and relate it to geology and seismicity of the area, and provide data for safe reconstruction and other earthquake engineering work. Nautical charting, aerial photography, post earthquake geodetic programs, and tidal program related to uplift and subsidence are described and illustrated.—GDC

Katz, J. L. *See* Blander, M. 02346

Kawashita, K. *See* Hurley, P. M. 02043

02178 **Kaye, Clifford A.** Fossiliferous bauxite in glacial drift, Martha's Vineyard, Massachusetts: Science, v. 157, no. 3792, p. 1035–1037, illus., table, 1967.

Pebbles of pisolitic bauxite occur in Pleistocene drift on Martha's Vineyard. The bauxite contains plant remains and relict quartz and was derived from plant bearing sediments, probably from the preglacial coastal plain of New England. The preservation of plant tissue suggests that bauxitization took place beneath, rather than above, the water table, as generally believed. This occurrence of bauxite is the northernmost known in eastern North America and suggests the possible existence of undiscovered deposits in the northern coastal plain.—Author's abstract

02245 **Keil, Klaus.** The electron microprobe X-ray analyzer and its application in mineralogy: Fortschr. Mineralogie 1966, v. 44, no. 1, p. 4–66, illus., tables, 1967.

The principle and instrumentation of the microprobe are described, and the techniques of sample preparation and qualitative and quantitative analysis reviewed. Quantitative analysis is discussed at length, especially secondary fluorescence. Applications included are mineral analysis and description, zonal structure, exsolution lamellae, diffusion and grain boundary phenomena, luminescent

properties, chemical composition, bulk and trace element analysis, modal analysis, and lattice parameter determinations.—ESL

Keller, W. D. *See* Reesman, A. L. 02142

Kennedy, Della L. *See* Cobb, Edward H. 02234

02332 **Kentucky Dept. Commerce Research Div.** Natural resources of Kentucky: Frankfort, Ky., Kentucky Dept. Commerce, 37 p., illus., tables, 1967.

Kentucky's principal mineral resources are coal, petroleum, natural gas, limestone and dolomite, clay, sand and gravel, fluorspar, and other vein minerals. Minerals of potential commercial significance include rock asphalt, gypsum, natural brines, oil shales, iron ores, rock phosphate, and dimension stone. Occurrences of each are described briefly in relation to geology and physiographic provinces of the state, along with production figures for 1964. A map showing mineral resources and mineral industries is adapted from a large scale publication of 1962. Water resources are reviewed also, both as to surface quality and ground water distribution and quality.—GDC

02294 **Keroher, Grace C.** Some uses of fossil names in the evolution of stratigraphic nomenclature in the Midcontinent, *in* Essays in paleontology and stratigraphy—R. C. Moore Commemorative Volume: Kansas Univ. Dept. Geology Spec. Pub. 2, p. 21–48, illus., 1967.

A review of the reports of the early Geological Surveys in the Midcontinent—Arkansas, Indiana, Iowa, Kansas, Kentucky, Missouri, and Tennessee—revealed that the practice of applying fossil names to stratigraphic units was quite common. Of the many fossil names so used, the Archimedes, Pentremital, Encrinital, Receptaculite, and Goniatite limestones, and the Equus beds have had usages that are of historical interest in the evolution of the stratigraphic nomenclature in the Midcontinent.—Author's summary

02290 **Kerr, J. William.** New nomenclature for Ordovician rock units of the eastern and southern Queen Elizabeth Islands, Arctic Canada: Bull. Canadian Petroleum Geology, v. 15, no. 1, p. 91–113, illus., 1967.

Ordovician rock units have commonly been misidentified and the nomenclature has become confused, largely through a paucity of fossils and the failure of workers to recognize that there are two major evaporite units. This paper reviews the earlier work and sets forth an expanded nomenclature. The Copes Bay Formation is now more accurately dated as early Canadian. The Baumann Fiord is a new formation of Canadian age whose type section occurs on Ellesmere Island. The Eleanor River Formation is now better dated as of Canadian age. The Cornwallis Formation is raised to group status and comprises three new formations: the Bay Fiord, Thumb Mountain, and Irene Bay Formations. The Cornwallis–Cape Phillips contact occurs within the Upper Ordovician.—*from* Author's abstract

11138 **Kerr, J. William.** Proterozoic through Devonian stratigraphy, central Ellesmere Island, N.W.T. [abs.], *in* Lower Paleozoic symposium: Bull. Canadian Petroleum Geology, v. 14, no. 4, p. 602–603, 1966.

Kerr, Paul F. *See* Rooney, Thomas P. 02231

01919 **Keys, W. Scott.** The application of radiation logs to ground-water hydrology [abs.]: Ground Water, v. 5, no. 3, p. 61, 1967.

02403 **Kier, Porter M.** Sexual dimorphism in an Eocene echinoid: Jour. Paleontology, v. 41, no. 4, p. 988–993, illus., 1967.

The new Eocene echinoid species, *Pentedium curator* n.g., n.sp., is apparently sexually dimorphic, the females having a brood pouch. The species was collected in a well in Georgia [near Brunswick, Glynn County, Lake City Limestone] and represents a new clypeasteroid genus in the family Neolaganidae. Its dimorphism

is similar to that found in the living *Fibularia nutriens* H. L. Clark.—Author's abstract

02214 **Kigoshi, Kunihiko.** Gakushuin natural radiocarbon measurements VI: Radiocarbon, v. 9, p. 43–62, 1967.

This continuation of the Gakushuin V list (1966) contains descriptions of geologic samples from Japan, Australia, and New Guinea; and archeologic samples from Iowa, Missouri, Kansas, Japan, Australia, New Hebrides, Malaya, and Iran.—MCM

Kim, S. M. *See* Noakes, John E. 02204

Kim, Stephen. *See* Noakes, John. 02345

02170 **King, Lewis H.** Use of a conventional echo-sounder and textural analyses in delineating sedimentary facies—Scotian Shelf: Canadian Jour. Earth Sci., v. 4, no. 4, p. 691–708, illus., tables, 1967.

The topographic features in the study area consist of two elongated basins and three isolated banks,the configuration conforming to other formerly glaciated shelves. Four types of sediment have been mapped from echograms, based on shape of the bottom surface as well as degree of compaction. An echo-sounder with a short pulse length and relatively high frequency was found suitable. Data from textural analyses on 141 samples correlate well with echogram results. These two techniques furnish a detailed picture of surficial bottom geology, and stratigraphic relations are sometimes revealed. The study suggests that the area was covered with glacial drift during the Pleistocene, which was reworked around the topographic highs during a subsequent low stand, and the finer sediment deposited in the basins.—ESL

11169 **King, Philip B.** The tectonic map of North America (scale 1:5,000,000), *in* Scientific communications read to the Commission for the Geological Map of the World: Paris, Internat. Geol. Cong., p. 17–31, 1966.

North America is divided tectonically into fold belts and platform areas where gently tilted rocks lie upon basements of earlier fold belts. Platforms with Precambrian basement are in the central cratonic region, those with Paleozoic basement are in the Atlantic and Gulf Coastal Plains. The upper surface of the basements beneath the platforms is shown by contours. Fold belts include four of Precambrian age, four mostly Paleozoic, two mostly Mesozoic, and two mostly Cenozoic. Each was formed during a geotectonic cycle, many periods in length. On the tectonic map, fold belts are distinguished by color, and the kinds of rocks by patterns. In some fold belts deposits were laid down in successor basins after the main orogeny. Granitic rocks are most extensive among the plutons and more mafic and alkalic varieties are separately indicated.—*from* Author's abstract

02324 **Klassen, Rudolph Waldemar.** The surficial geology of the Riding Mountain area, Manitoba-Saskatchewan [abs.]: Bull. Canadian Petroleum Geology, v. 15, no. 2, p. 217, 1967.

02192 **Klein, George deVries.** Comparison of Recent and ancient tidal flat and estuarine sediments, *in* Estuaries (edited by George H. Lauff): Am. Assoc. Adv. Sci. Pub. 83, p. 207–218, illus., 1967.

Tidal flats are of two types, here designated as Wadden-type for soft sediment coasts such as the Netherlands, and Fundy-type for bedrock coasts such as Nova Scotia. Estuarine sedimentation, dominated by a circulation plan, is superimposed on tidal channels, tidal marsh, lagoon, river, and deltaic environments. Characteristic vertical sequences of river estuaries record the predominant regimes of erosion and deposition. Ancient counterparts of estuaries are indicated by studies of the Coal Measures of Pennsylvania and the Berea Sandstone of Ohio. The Middle Jurassic series of Great Britain may represent lagoonal environments on which an estuarine circulation system was imposed. Deposition of evaporites in mixed shallow marine environments required an estuarine circulation in an arid climate to supply enough salt water.—GDC

11122 **Klement, Karl W.** Studies on the ecological distribution of lime secreting and sediment trapping algae in reefs and associated environments [with German abs.]: Neues Jahrb. Geologie u. Paläontologie Abh., v. 125, nos. 1–3 (Festband Schindewolf), p. 363–381, illus., tables, 1966.

Algal occurrences are compared in the Recent reef environment of the Florida Keys and a Permian reef complex in the Guadalupe Mountains of Texas and New Mexico; both environments seem to represent physically similar shelf edge locations of carbonate deposition. Corallinaceae are common in areas of high wave action in the outer reef tract; Solenoporaceae, their forerunners, abound in the Permian fore-reef talus, reef core, and reef flat. Codiaceae and Dasycladaceae are abundant in shallow, quiet water of back-reef areas, and are locally rock forming in the Permian back-reef deposits. Algal mats, with entrapped sediment, formed by primitive green and blue-green algae, are found in interior lagoons of mangrove keys; stromatolites, their ancient equivalents, are common in the lagoonal facies of the Permian back-reef deposits.—*from* Author's abstract

02075 **Klemic, Harry; Ulrich, George E.** Geologic map of the Roaring Spring quadrangle, Kentucky-Tennessee: U.S. Geol. Survey Geol. Quad. Map GQ-658, scale 1:24,000, section, 1967.

02269 **Klohn, Earle J.** Design and performance of earthwork and foundations for the Squaw Rapids development, *in* Canadian Soil Mechanics Conf., 19th, 1966, [Pt.] 2: Canadian Geotech. Jour., v. 4, no. 2, p. 244–301, illus., table; reply to discussions, p. 308–311, 1967.

The Squaw Rapids development on the Saskatchewan River, 175 mi north of Saskatoon, Saskatchewan, includes an earthfill dam, overflow spillway, powerhouse, and system of dikes for high water. About 280 feet of overburden is present above a dense uncemented sand about 60 feet thick in the Cretaceous Swan River Group, the source of strong artesian flow at depth. Three till sheets separated by lacustrine deposits or unconformities overlain by postglacial flood plain deposits have been identified. Preliminary data indicated that the glacial till would provide an excellent foundation, but pockets of plastic clay, and the extent of the artesian aquifer were studied further. An appendix summarizes the physical properties of all major soils; subsoil sections are given. Construction and performance of all structures, and behavior of the artesian aquifer as the reservoir filled are discussed in detail.—ESL

02032 **Knapp, David G.** Charting magnetic dip poles and associated field patterns: Royal Astron. Soc. Geophys. Jour., v. 12, no. 5, p. 499–510, illus., 1967.

The elongated configuration of potential in the Arctic calls for special techniques of magnetic cartography. The paper explains the procedures developed by the author, involving the resolution of the horizontal components of the field vector and of the secular change vector into components parallel and perpendicular to an appropriately chosen meridian. Stress is placed on the ways in which the presence of elongation affects certain postulates otherwise valid in the polar vicinity, and on the importance of appropriate treatment of secular change. The paper concludes with a discussion of the technique of deriving the drift of a dip pole.—Author's abstract

02213 **Knauer, G. A.; Martin, J. R.; Goodell, H. G.; Phelps, D. S.** Florida State University radiocarbon dates II: Radiocarbon, v. 9, p. 38–42, 1967.

This compilation of samples dated since September 1965 includes a continuation of several series begun in FSU I (1966) as well as new series undertaken since that time. Geologic samples are from Florida and the English Channel, archeologic samples from Georgia, Florida, and North Carolina.—MCM

Knopoff, Leon. *See* Burridge, R. 02063

01936 **Knostman, R. W.** An analysis of the Pacific Northwest lead-zinc industry: U.S. Bur. Mines Inf. Circ. 8327, 53 p., illus., tables, 1967.

Among lead–zinc regions in the United States the Pacific Northwest ranks third in measured and indicated reserves of lead, and is tied for third in zinc reserves. All categories of reserves in the region contain 1.56 million tons of lead and 2.59 million tons of zinc. General distribution of reserves and potential resources, coproducts and byproducts, past production, economic aspects of lead–zinc mining, and future production trends are outlined.—APB

02367 **Kobal, Arthur L., Jr.** (compiler). Index to graduate theses and dissertations on California geology—1962 through 1965: California Div. Mines and Geology Mineral Inf. Service, v. 20, no. 8, p. 98–103, illus., 1967.

This supplement to California Div. Mines and Geology Spec. Rept. 74 (Jennings, 1963) contains 236 theses titles, of which 32 are from schools outside the State. Part 1 lists theses regarding specific areas which are plotted on a map; part 2 lists broad or regional studies grouped into fields of interest. Information on availability of theses is included.—MCM

01990 **Koch, George S.; Link, Richard F.** A simulation of ghost stratigraphy, *in* Computer applications in the earth sciences—Colloquium on trend analysis: Kansas Geol. Survey Computer Contr. 12, p. 22–25, illus., tables, 1967.

A quadratic equation is fitted to illustrative data simulating ghost stratigraphy. The patterns found among the residual variations indicate the nature of the rock before metamorphism. Thus, the complications of a specific model are shown, and an instructive use of simulation is illustrated.—Authors' abstract

02391 **Koch, Henning F.** The diabase of the Butner–Creedmoor area, Granville County, North Carolina: Southeastern Geology, v. 8, no. 2, p. 73–79, illus., table, 1967.

Reconnaissance mapping of residual soils and boulders of diabase reveals the presence of some large diabase units in the area. In many instances the boundaries of this material coincide with boundaries of the Iredell Clay Loam. The diabase occurs as vertical dikes and as sheet-like bodies of great areal extent, usually less than 80 feet thick. Field data suggest a flow-like structure for some of the larger bodies. Crystal size decreases from the center toward the edges, and in areas believed to be feeder zones, the crystals are appreciably larger. Contact between the diabase and underlying and overlying sediments suggests erosion surfaces. It is felt that the extrusion and intrusion of the diabase occurred during the later Upper Triassic. A geologic sketch map is included.—ESL

02348 **Koch, Neil C.** Disappearance of the dinosaurs: Jour. Paleontology, v. 41, no. 4, p. 970–972, table, 1967.

Selenium may have been the main cause for the extinction of dinosaurs and other animal species at the end of the Mesozoic Era. Selenium was deposited throughout the world from volcanic lava and gases in Mesozoic time. The decay of selenium-bearing rocks probably produced seleniferous vegetation. These toxic plants were eaten by the herbivorous dinosaurs, whereas the meat-eating animals were slowly poisoned by the selenium ingested and retained in the fatty tissue and bones of foraging animals.—Author's abstract

Koffman, D. M. *See* Dodd, R. T., Jr. 02344

02133 **Koontz, Terry.** Geology and petroleum of McIntosh County, Oklahoma—Pt. 2, Petroleum geology of McIntosh County: Oklahoma Geol. Survey Bull. 111, p. 50–67, illus., table, 1967.

Since 1912, 442 tests for oil and gas were drilled through December 31, 1966. Of this total, 19 were completed as oil wells and 167 as gas wells; the remainder were dry holes. On December 31, 1965, the county had 13 producing oil wells and 28 producing gas wells. Production is primarily from Pennsylvanian sandstones. Hydrocarbon accumulation is generally structurally controlled, but in many instances stratigraphic factors limit production. A normal sequence of rocks from Pennsylvanian (Des Moines) to Ordovician (Arbuckle) is penetrated by wells drilled in the county. Basement rock has not been reached by drilling, the deepest

penetration into the Arbuckle Group being 469 feet. Two nearby wells in adjacent counties have found 1,082 feet and 1,434 feet of Arbuckle rocks overlying the basement.—*from* Author's abstract

02387 **Krauskopf, Konrad B.** Introduction to geochemistry: New York, McGraw-Hill Book Co. (Internat. Ser. Earth and Planetary Sci.), 721 p., illus., tables, 1967.

This textbook assumes only an elementary chemistry background, the necessary concepts from physical chemistry are introduced gradually. Abstract chemical ideas and chemical arguments are applied to geologic problems. The 21 chapters cover: chemical equilibrium, acids and bases, carbonate sediments, chemical weathering, structural chemistry, colloids, clay minerals and soils, free energy, oxidation potentials, Eh–pH diagrams, oxidation and reduction in sedimentation, organic material in sediments, evaporites, phase rule, magmatic crystallization, volcanic gases, ore-forming solutions, oxidation of ore deposits, metamorphism, distribution of elements, and historical geochemistry. Tables of solubility products, free energies, and oxidation potentials are included.—LLP

Kresl, Ronald J. *See* Bluemle, John P. 01980

02070 **Krieger, Medora H.** Reconnaissance geologic map of the Picacho Butte quadrangle, Yavapai and Coconino Counties, Arizona: U.S. Geol. Survey Misc. Geol. Inv. Map I-500, scale 1:62,500, 1967.

01968 **Krijnen, J. P.** Pseudorbitoid foraminifera from Curaçao, [Pts.] 1–2: Koninkl. Nederlandse Akad. Wetensch. Proc., Ser. B, v. 70, no. 2, p. 144–164, illus., tables, 1967.

Several larger foraminifers of the family *Pseudorbitoididae* Rutten are found in calcarenitic limestones, designated the Cas Abao limestone lenses, which occur in a eugeosynclinal succession of Upper Cretaceous and lower Tertiary age on the island of Curaçao. A new species, *Pseudorbitoides curaçaoensis*, is believed to be a very primitive form of the genus, and *Sulcorbitoides pardoi*, identified from vertical sections, is barely distinct from juvenile forms of *P. curaçaoensis*. The determination of *Aktinorbitoides browni* is based on interruption of radial elements; the delicate structures, typical for the genus, seemed to be effaced by recrystallization. Formal descriptions are given for all three species.—GDC

01988 **Krumbein, W. C.** FORTRAN IV computer programs for Markov chain experiments in geology: Kansas Geol. Survey Computer Contr. 13, 38 p., illus., tables, 1967.

First-order Markov chains are emphasized because of their intuitive appeal and rapidly growing applications. Examples are based on stratigraphic analysis, but other uses of the model are discussed briefly. Computer programs to cover four aspects of analysis are: (1) testing the presence of a Markov property, (2) raising the transition probability matrix to successive powers in order to estimate the equilibrium states of the system, (3) using the transition matrix in simulation studies, and (4) simulating independent-events processes that can be used with the fixed probability vector of a Markov chain to obtain comparisons among different ways of structuring a sequence of events or observations.—*from* Author's abstract

01993 **Krumbein, W. C.** The general linear model in map preparation and analysis, *in* Computer applications in the earth sciences—Colloquium on trend analysis: Kansas Geol. Survey Computer Contr. 12, p. 38–44, illus., tables, 1967.

The general linear model is the connecting thread that weaves through many aspects of map preparation, map analysis, and map interpretation. In its conventional form the general linear model is the basis for such multivariate maps as the Q-mode factor map and the discriminant function map, and in its two-dimensional form, is the basis for the polynomial and Fourier map-analysis models, both of which are widely used in a variety of geologic fields. All variants of the general linear model can be reduced to a simple matrix equation. Coefficient space is further examined, and the extension of map analysis to the estimation of "trends" in coefficient matrices is introduced with an example.—*from* Author's abstract

Krushensky, R. D. *See* Hinrichs, E. Neal, 02073

11129 **Kuellmer, F. J.; Visocky, A. P.; Tuttle, O. F.** Preliminary survey of the system barite–calcite–fluorite at 500 bars, *in* Carbonatites (O. F. Tuttle and J. Gittins, editors): New York, Interscience Publishers, p. 353–364, illus., tables, 1966.

Disregarding the incongruent melting of calcite, melting relations of barite–calcite–fluorite at 500 bars are those of a simple ternary eutectic system. The ternary eutectic is at 824°C with a composition of $B_{22}CC_{52}CF_{26}$. Adding water to the system lowers the eutectic but because of dissociation the system is not quaternary. Addition of water as portlandite generates a univariant curve which originates at the ternary isobaric eutectic and terminates at a quaternary isobaric eutectic at the composition $B_2CC_{15}CF_{15}CH_{12}$ at 576°C. Melting relations within this sytem provide additional verification for the magmatic origin of carbonatites. A variable volatile content accompanied by fractional crystallization could have a considerable effect on the paragenetic sequence of many Ba–Ca–F dikes associated with carbonatites.—*from* Authors' summary

02153 **Kulm, L. D.; Byrne, John V.** Sediments of Yaquina Bay, Oregon, *in* Estuaries (edited by George H. Lauff): Am. Assoc. Adv. Sci. Pub. 83, p. 226–238, illus., 1967.

Yaquina Bay, extending inland 23 miles at Newport, Oreg., has mixed semidiurnal tides averaging 5.5 feet in range. Three realms of deposition are defined on the basis of sediment texture and mineralogy; maximum sedimentation occurs in the bay during the winter. Chief sources of Recent sediments are Tertiary rocks of the bordering Coast Range, Pleistocene marine terraces and estuarine deposits near the bay mouth, and Recent beach and dune sands flanking the entrance. Tidal currents transport to a point six miles inside; dune sands are blown into the tidal channel and onshore to a tidal flat; suspended river sediments enter in high runoff. Shoals have remained constant for 12 years on the bar, in main channel, and in the turning bay. About 275 cu yd of sediment accumulated on a beach behind the south jetty from 1888 to 1961.—GDC

02361 **Kvenvolden, Keith A.; Squires, Rodney M.** Carbon isotopic composition of crude oils from Ellenburger Group (Lower Ordovician), Permian basin, West Texas and eastern New Mexico: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 7, p. 1293–1303, illus., tables, 1967.

Crude oils in the Ellenburger Group can be arranged into five groups based on carbon isotopic composition, geographic position, and stratigraphic relations. One group has unusually low isotopic values compared with those of most other crude oils of the world. The Ellenburger contains oils of many ages, from Early Ordovician through Early Permian. Carbon isotopic compositions are useful in relating and distinguishing crude oils on a regional basis.—WLA

02164 **Lajtai, Emery Zoltan.** The origin of some varves in Toronto, Canada: Canadian Jour. Earth Sci., v. 4, no. 4, p. 633–639, illus., 1967.

A section of varved clays in a subway excavation in Toronto, Ontario, is described. Varves are noted for such irregular features as erosional structures, poor sorting, sublaminations, and angular fragments of unconsolidated material scattered in the coarse grained layer. On the basis of sorting and grading of the coarse-grained layer, three groups are distinguished: graded, complex, and diamictic. The typical complex varves were probably deposited by bottomflows varying in sediment load. Sedimentation is influenced by three overlapping processes: settling from a graded suspension, addition of coarse sediments rolled on the bottom, and deposition from a uniform suspension. Textures reflect variations in coarse-sediment load due to temperature variations affecting melting of the glacier. Deposition of graded and diamictic varves probably is from single overflows or bottomflows.—ESL

11181 **Lamar, J. E.; Harvey, Richard D.** Geology of cement raw materials in Illinois, *in* Symposium on geology of cement raw materials—Forum on geology of industrial minerals, 2d, 1966, Proc.: Bloomington, Ind., Indiana Geol. Survey and Indiana Univ., p. 45–71, illus., tables [1966?].

Limestones of potential use as cement making materials occur in the extreme southern, southwestern, and western parts of Illinois. Those of central Illinois are of limited use for cement making because they generally are thin, and those in the northern part of the State have only restricted possibilities because their magnesium content is high. A general discussion of the chemical composition, thickness, and availability of Illinois limestones is presented. The clays and shales available in each of these areas are evaluated in terms of alkali equivalents and silica ratios.—Authors' abstract

LaMarche, V. C., Jr. *See* Barnes, Ivan. 01962

01928 **Landes, Kenneth K.** Serendipity and mineral discovery: New York Acad. Sci. Trans., ser. 2, v. 29, no. 3, p. 293–300, 1967.

Most discoveries of one mineral commodity while searching for another (serendipity) have been made in sedimentary basins as a result of extensive petroleum search. Each year millions of feet of well sections are measured and studied in detail in the field and laboratory. Cases of serendipity and mineral deposits are reviewed and future serendipitous discoveries evaluated.—LLP

11202 **Landes, Kenneth K.** Chemical variations in commercial limestone deposits, *in* Symposium on geology of cement raw materials—Forum on geology of industrial minerals, 2d, 1966, Proc.: Bloomington, Ind., Indiana Geol. Survey and Indiana Univ., p. 83–89, illus., tables [1966?].

Chemical variations in carbonate rock formations are the rule rather than the exception, and are both vertical and lateral. Abrupt increase in the percentage of impurities toward the base of formations has been noted, and the author believes it represents an unconformity. Silica and magnesia logs of the Dundee Limestone, southeastern Michigan, are given as examples. Chemical analyses of Ordovician dolomite, Pennsylvania, show erratic behavior from top to bottom. Silica and magnesia logs of the Ste. Genevieve Limestone, Kentucky, illustrate lateral variations.—ESL

02116 **Landry, Stuart O., Jr.** Disappearance of multituberculates [discussion of paper by L. VanValen and R. E. Sloan, 1966]: Systematic Zoology, v. 16, no. 2, p. 172–173, 1967.

VanValen and Sloan (ibid., v. 15, no. 4, p. 261–278, 1966) have criticized Landry's views (Jour. Mammalogy, v. 46, no. 2, p. 280–286, 1965) on relation of the increase of rodents in the fossil record of western North America to the decline and extinction, in late Eocene, of the multituberculate mammals. Landry attacked only the theory that the multituberculates were displaced by rodents in direct competition for the "niche" of gnawing mammals; he maintains that the theory is untenable because most of the multituberculates did not gnaw. Landry quotes three statements from VanValen and Sloan's paper that support his position. He offers the hypothesis that, as rodents and raptorial birds were adaptively radiating at the same time, rodents were able to adapt to this new predation pressure but multituberculates and primates were not.—VMJ

02389 **Lane, H. Richard.** Uppermost Mississippian and Lower Pennsylvanian conodonts from the type Morrowan region, Arkansas: Jour. Paleontology, v. 41, no. 4, p. 920–942, illus., tables, 1967.

Four conodont zones are recognized in the Chesterian and Morrowan rocks of north-central and western Arkansas. In ascending order they are the *Adetognathus unicornis* Zone in the upper 15 feet of the Pitkin Limestone; the *Idiognathoides* aff. *I. nodulifera*, *Gnathodus bassleri symmetricus*, *and Gnathodus bassleri bassleri* Zones in the interval between the base of the Prairie Grove Member of the Hale Formation (Morrowan) and the top of the Brentwood Member of the Bloyd Formation (Morrowan). Post-Brentwood Bloyd strata are characterized by *Idiognathus* Gunnell. Eleven genera are recognized. *Adetognathus* n.gen. is proposed for Pennsylvanian forms referred previously to *Cavusgnathus* Harris and Hollingsworth, which is restricted herein to Mississippian forms.—*from* Author's abstract

Lane, N. Gary. *See* Webster, G. D. 02271

01937 **Langenheim, Jean; Hackner, Betty L.; Bartlett, Alexandra.** Mangrove pollen at the depositional site of Oligo–Miocene amber from Chiapas, Mexico: Harvard Univ. Bot. Mus. Leaflets, v. 21, no. 10, p. 289–324, illus., table, 1967.

Pollen from 12 rock samples from Chiapas, either from strata containing amber or immediately adjacent to them, were studied. Samples vary little in lithology, are from strata considered to be latest Oligocene or earliest Miocene in age, and represent a small interval of geological time. The palynological data indicate complex mangrove vegetation close to the depositional site of the amber. The most important elements were members of the genus *Rhizophora*. Environmental conditions suggested and supported by geological evidence are those along a coastline of a shallow, tropical sea with occasional shoreline fluctuations. The significant absence of *Pinus* in the amber-bearing beds seems to support a source tree other than pine.—GDC

02018 **Langway, C. C., Jr.** Stratigraphic analysis of a deep ice core from Greenland: U.S. Army Materiel Command Cold Regions Research and Eng. Lab. Research Rept. 77, 130 p., illus., tables, 1967.

A deep rotary core drilling project on the icecap provided ice core to a depth of 411 m. Vertical variation in bulk density, macroscopic structure, oxygen isotope ratios, ionic constituents, and extraterrestrial dust were analyzed; data permit direct estimation of annual accumulation layers. The average ionic concentration in the icecap ranges from 0.65 to 1.35 mg/liter. The annual global mass deposit of black spherules varies from 2.10×10^5 metric tons in 700 yr old ice to 6.57×10^5 in 12 yr old firn. The oxygen isotope ratio variation provides the best means of estimating accumulation at depth. The record shows snow accumulation and temperatures in A.D. 934 similar to those of today, followed by a gradual decrease in accumulation to a minimum in the late 18th century, and an increase in both accumulation and temperature from 1773 to the present.—ESL

Larkin, David. *See* Dempsey, Michael. 11189

02377 **LaRocque, A.** Pleistocene Mollusca of the Ladds deposit, Bartow County, Georgia: Georgia Acad. Sci. Bull., v. 25, no. 3, p. 167–187, 1967.

Twenty-five species of mollusks, of which 22 were identifiable to species, are recorded for the Ladds deposit. They include one freshwater pelecypod, one amphibious gill-breathing gastropod, and 23 land snails. [The assemblage provides no indication as to age; it consists of fresh shells, together with shells long exposed to erosion, all transported by rills and sheet flow to the fissure deposit.] Twenty-three of the species have been recorded from Georgia as living forms, and the other two were to be expected [as living forms] in the State. The [living] nonmarine Mollusca of Georgia are listed for comparison with the collection studied. For each species identified in the Ladds deposit, data on general distribution, fossil occurrence, and ecologic preferences are given.—Author's abstract

Laster, Stanley J. *See* Linville, A. Frank. 02062

02187 **Lauff, George H.** (editor). Estuaries: Am. Assoc. Adv. Sci. Pub. 83, 757 p., illus., tables, 1967.

This book is an outcome of the Conference on Estuaries, held at Jekyll Island, Ga., in 1964, to provide an exchange of ideas between the various disciplines and individuals interested in estuarine research. The subject matter includes aspects of biology, chemistry, geography, geology, and physics; seventeen papers are cited individually. A supplemental list of references contributed by the authors, and selected additions published since 1964 are included to update the volume and enhance its effectiveness as a source book on estuaries.—GDC

Leahy, E. J. *See* Giblin, P. E. 01963

Leahy, E. J. *See* Bennett, G. 02383

LeGrand, Harry E. *See* Carolina Geological Society, 11127

11172 **Lehrman, Robert L.** Race, evolution, and mankind: New York, Basic Books, 280 p., illus., 1966.

An objective view of recent discoveries in anthropology, psychology, taxonomy, and population genetics indicates the essential equality of the races under conditions of modern life. The knowledge that these sciences have given about the nature of human races is summarized here for the layman; extensive attention is given to animals and to birds in particular. The ten chapters discuss classification, speciation, variations, evolution, racial structure, and human origins. It is noted that fossil remains give little or no evidence for the prevalent conceptions of racial types, although skeletal characteristics are very well known. There is a period of 12 million years in which there are no fossils to show where Man fits into the evolutionary complex.—GDC

Leonard, A. Byron. *See* Frye, John C. 02287

Levin, Betsy. *See* Ives, Patricia C. 02226

02315 **Lewis, D. W.** Cambrian (pre-Beekmantown) sedimentation in S. W. Quebec with special reference to three deep wells near Montreal [abs.]: Bull. Canadian Petroleum Geology, v. 15, no. 2, p. 213, 1967.

Lewis, James G. *See* Thompson, Morris M. 11163

02140 **Libby, W. F.** Radiocarbon and paleomagnetism, *in* Magnetism and the cosmos—NATO Advanced Study Inst. Planetary and Stellar Magnetism, Univ. Newcastle upon Tyne, 1965: New York, American Elsevier Publishing Co., p. 60–65, 1967.

Possible disturbances in the radiocarbon content of living matter that could cause significant error in radiocarbon dates are in two categories: disturbances of rate of production of C-14 by cosmic rays and disturbances of the mixing reservoir of exchangeable carbon with which high atmosphere radiocarbon is mixed in the 8300 yr lifetime of C-14. Of all possible disturbances, variation of the Earth's magnetic field is the most likely to have been important, and, therefore, paleomagnetism can be studied by means of C-14 dates and their accuracy judged by tree rings and historical records.—VSN

Libby, W. F. *See* Berger, Rainer, 02225

Link, Richard F. *See* Koch, George S. 01990

02062 **Linville, A. Frank; Laster, Stanley J.** Near-surface dispersion studies at Tonto Forest Seismological Observatory: Seismol. Soc. America Bull., v. 57, no. 3, p. 311–340, illus., tables, 1967.

Four local seismic events digitally recorded on a crossed linear array have been analyzed to evaluate the representation of wave propagation in inhomogeneous earth models in terms of "local" dispersion. Frequency wave number spectrums are computed by various methods; the best method is a combination using averaged correlations computed from pre-whitened data. The utility of computing dispersion curves from an estimation of the "transfer function" has been evaluated. The studies show the necessity of recording data directly "inline" in areas of rough topography between source and array if "local" dispersion is to be measured. The signals are highly nonstationary in space.—*from* Authors' abstract

02347 **Lipps, Jere H.** Planktonic foraminifera, intercontinental correlation and age of California mid-Cenozoic microfaunal stages. Jour. Paleontology, v. 41, no. 4, p. 994–999, illus., 1967.

The California microfaunal stages previously defined on benthonic Foraminifera are correlated with the planktonic biostratigraphic zones recognized throughout the

tropical regions and with the type European mid-Cenozoic stages. Planktonic Foraminifera useful for correlating California stages directly with the tropics occur in the Refugian, Relizian, Luisian, and middle Mohnian. Radiometric age correlation of the California mid-Cenozoic microfaunal stages with planktonic zones elsewhere is not presently possible, but correlations can be made between the mid-Cenozoic microfaunal stages of California and the type European stages. Thus, the uppermost Refugian of California is late Eocene; the Zemorrian is latest Eocene or Oligocene to earliest Miocene; and the Saucesian through Delmontian are early to late Miocene.—JFM

02330 **Lipps, Lewis; Ray, Clayton E.** The Pleistocene fossiliferous deposit at Ladds, Bartow County, Georgia: Georgia Acad. Sci. Bull., v. 25, no. 3, p. 113–119, illus., 1967.

The fissure fillings of the Ladds site at Quarry Mountain, 2.3 miles west-southwest of Cartersville, Bartow County, have yielded the first extensive Pleistocene vertebrate (78 species) and nonmarine molluscan (25 species) assemblage from Georgia. The locality lies in a geographic gap for comparable Pleistocene deposits previously extending from north-central Florida to north-central Tennessee.—Authors' summary

Loeblich, A. R. *See* Tappan, H. 11168

02071 **Loney, Robert A.** Geologic map of the Hollyhill quadrangle, McCreary and Whitley Counties, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ 615, scale 1:24,000, section, text, 1967.

Commercial exploitation of resources in the Hollyhill quadrangle has been confined to mining of coal, principally from the Jellico and River Gem beds; there was one active mine in 1963. Thickness of the Jellico is from 25–41 inches, of the River Gem about 25 inches. To aid the reader in comparing the geology of the Hollyhill quadrangle with that shown on three published maps of adjoining quadrangles—Cumberland (Smith, 1963), Whitley City (Pomerene, 1964), and Ketchen (Englund, 1966)—Loney discusses the Pennsylvanian units from the Marsh Creek Sandstone Tongue of the Lee Formation to the Breathitt Formation.—MCM

02223 **Long, Austin; Mielke, James E.** Smithsonian Institution radiocarbon measurements IV: Radiocarbon, v. 9, p. 368–381, 1967.

Most of these analyses were obtained during 1966 on archeologic samples from the United States, Mexico, Guatemala, Honduras, Colombia, Brazil, Ecuador, and Iran; on geologic samples from Ellesmere Island (Northwest Territories), Alaska, and Israel; and on one geochemical sample from Florida.—MCM

01915 **Loring, D. H.** Resume of marine geological investigations carried out by the Atlantic Oceanographic Group in the Gulf of St. Lawrence, 1964–1966: Maritime Sediments, v. 3, no. 1, p. 24–26, 1967.

A study of sediments on the Magdalen Shelf shows only an intermittent veneer over the sandstone bedrock between Prince Edward Island and the Magdalen Islands, while elsewhere the floor is covered with sediments, mainly erosional products of the bedrock. Submarine troughs and tunnel valleys show the effects of glaciation rather than the present environment. In the northeast Gulf, the floor is divided obliquely by a topographic high, north of which topography is rugged, with several deep basins, and south of which the Esquiman Channel extends southwestward to join the Laurentian trough. Sand and gravel are dominant sediment types. Geochemical investigations summarized include calcium carbonate in marine sediments, major element distribution in size fractions, composition of sands, and iron compounds and oxides in the sediments.—ESL

02216 **Lowdon, J. A.; Fyles, J. G.; Blake, W., Jr.** Geological Survey of Canada radiocarbon dates VI: Radiocarbon, v. 9, p. 156–197, tables, 1967.

Age calculations have been carried out monthly from October 1965 through September 1966 on an IBM 1620 computer. All samples (geologic) are grouped

into eastern, western, and northern (mainland and Arctic Archipelago) Canada.—MCM

Luft, S. J. *See* Hinrichs, E. Neal. 02073

01971 **Luyendyk, Bruce P.; Melson, William G.** Magnetic properties and petrology of rocks near the crest of the Mid-Atlantic ridge: Nature, v. 215, no. 5097, p. 147-149, table, 1967.

Measurements of the magnetic properties (susceptibility, remanent magnetization, Q factor) of three fresh basalts, three basaltic breccias, and three greenstones dredged from the Mid-Atlantic Ridge are tabulated, together with brief petrological descriptions. The results show that vertical zones of hydrothermal alteration of basalts or peridotites along fracture zones should strongly influence the magnetic anomaly patterns over the Mid-Atlantic Ridge.—DBV

Lyall, A. K. *See* Swift, D. J. P. 01942

11217 **Machairas, G.** La métallogénie du cuivre dans la région de Noranda (Québec): [France] Bur. Recherches Géol. et Minières Bull. 1966, no. 4, p. 113-133, illus., 1966.

In the Lac Dufault and other mines of the Rouyn-Noranda area, deposits of copper and other metals, mainly as massive sulfides, have been formed in three phases, at different times and under different conditions. The first phase was epithermal; fumarolic solutions deposited pyrite as spherulites in Keewatin rhyolites. The second phase, the main mineralization, was hydrothermal, at high temperatures; pyrrhotite, sphalerite, chalcopyrite, and many other ore minerals were deposited in lenses and masses, showing fluidal structures and microzones, in association with contact metamorphism of the volcanic rocks during intrusion of post-Keewatin diorite and granodiorite. In the third phase, much later, abundant crystalline calcite and some sphalerite, pyrite, and chalcopyrite were deposited at rather low temperatures in fractures in ores of the preceding phases.—VMJ

Macintyre, R. M. *See* Gittins, J. 02166

02121 **Mackenzie, Michael G.** Environments of deposition on an offshore barrier sand bar, Moriches Inlet, Long Island, New York: Tulane Studies Geology, v. 5, no. 2, p. 67-80, illus., tables, 1967.

Environments of deposition were studied by mechanical analysis and heavy mineral analysis. Two distinct sedimentary regimes are defined: the forebar and the backbar; backbar sands are better sorted and finer grained than those of the forebar. The hydraulic equivalent concept is applicable to both wind blown and water-transported sands. Heavy mineral content by weight increases with better sorting and smaller mean diameter. It is concluded that lateral mineralogical and textural variations and gross geometric properties will aid in the interpretation of the genesis and history of fossil shoestring sands.—LLP

11149 **Malkin, N. P.** Otstupaniye amerikanskogo lednika i smeshcheniye putey tsiklonov: Vses. Geog. Obshch. Izv., v. 98, no. 4, p. 326-332, illus., 1966.

The course of continental glaciation is controlled by the paths of cyclones, which are in turn affected by the regional relief and local sources of moisture. Data are presented from the Great Lakes region to substantiate this hypothesis.—JWC

02275 **Marlowe, J. I.** The geology of part of the continental slope near Sable Island, Nova Scotia: Canada Geol. Survey Paper 65-38, 30 p., illus., table, 1967.

Core and dredge samples and echo-sounding records provide data on the bottom sediment, geomorphology, and structure. A large canyon, The Gully, adjacent to Sable Island is of special interest. Comparison of profiles with others along the east coast suggests that benches occurring on the slope and in The Gully reflect the presence of outcropping bedrock. Unconsolidated sediment on the shelf consists mainly of sand and gravel, while that on the slope is predominantly mud. Thin

layers of sand occurring in some cores from the slope suggest that sand from the shelf is periodically transported downslope. Resistant, compact siltstone and sandstone occur at some localities in The Gully. Foraminifera indicate that some of the siltstone may be as old as Miocene. Other compact sediments are lithologically similar to formations that occur in Georges Bank. [A contoured bathymetric chart is in pocket.]—*from* Author's abstract

Martin, J. R. *See* Knauer, G. A. 02213

11203 **Martin, N. W.; Gibson, R. C.** Deleterious constituents in cement raw materials, *in* Symposium on geology of cement raw materials—Forum on geology of industrial minerals, 2d, 1966, Proc.: Bloomington, Ind., Indiana Geol. Survey and Indiana Univ., p. 91–100, tables [1966?].

The deleterious constituents are discussed on the basis of their mineralogic and lithologic occurrences rather than on an oxide basis. A deleterious constituent is defined as a component which adversely affects the quality and (or) marketability, or appreciably increases production costs. The most common are K_2O and Na_2O in feldspars, micas, illite; MgO in dolomite, periclase; SO_3 in gypsum, pyrite; P_2O_5 in collophane, apatite; and SiO_2 in chert, chalcedony, quartz. [Fe_2O_3 and Mn_2O_3 affect the color.]—*from* Authors' abstract

11141 **Martin, Rudolf.** Discussion [of "Exploration for natural gas" by E. H. Rainwater, 1966], *in* Natural gas—Inst. Petroleum, Explor. and Production Group, Symposium, London, 1966, Proc.: London, Elsevier Publishing Co., p. 30–31, 1966.

In discussion of exploration of natural gas, consideration of its chemical composition is essential; non-hydrocarbon components such as helium and hydrogen sulphide are of commercial significance, whereas nitrogen and carbon dioxide should be avoided. The problem is partly one of migration, and partly that source rocks of natural gas include many which are not also source rocks of petroleum. The migration of gas, when not dissolved in petroleum or salt water, is very different from that of liquids, particularly light gases. This may lead to differential trapping of individual components. There is a large field of research into these problems of origin and migration of natural gas, as distinct from those of petroleum. Exploration should make use of geochemical and physical principles as well as the geological principles dealt with by Dr. Rainwater (ibid., p. 1–31).—GDC

02056 **Mason, Brian; Jarosewich, Eugene.** The Winona meteorite: Geochim. et Cosmochim. Acta, v. 31, no. 6, p. 1097–1099, table, 1967.

The Winona meteorite (found in 1928 near Winona, 15 miles east of Flagstaff, Ariz.) consists largely of enstatite (Fs_6) and olivine (Fa_5) with nickel-iron, plagioclase (An_{10}), and troilite, plus accessory diopside, chromite, apatite, daubreelite, graphite, and alabandite. A chemical analysis and rare gas content are given.—DBV

02057 **Mason, Brian.** Olivine composition in chondrites—A supplement: Geochim. et Cosmochim. Acta, v. 31, no. 6, p. 1100–1103, tables, 1967.

Olivine compositions are given for 122 olivine-bronzite and olivine-hypersthene chondrites. From these data and those of an earlier paper [1963] the numbers of the different classes of chondrites are: enstatite, 16; olivine-bronzite, 430; olivine-hypersthene, 496; carbonaceous, 33. It is suggested that the term olivine-pigeonite chondrite be abandoned, and those meteorites included with the carbonaceous chondrites.—Author's abstract

01956 **Mathiesen, Fr. J.** Notes on some fossil phryganidean larval tubes from the Tertiary of Denmark and Greenland [with Danish abs.]: Dansk Geol. Foren. Medd., v. 17, no. 1, p. 90–94, illus., 1967.

Larval tubes similar to those produced by certain species of the insect family Phryganeidae [caddisflies] are described from Tertiary deposits of Denmark and Greenland. Specimens of such larval tubes [formerly regarded as fossil *Equisetum* stems] are common in a layer of hardened gyttja in the Neogene lignite at Silkeborg Vesterskov, central Jutland. A single specimen has been obtained from the

Paleogene ferruginous shales of Igdlokunquaq, Disko island, West Greenland. *Taxodium* needles have served as building material for the larval tubes from the lignite, usually found as fragments, some only slightly damaged; the Greenland specimen, too poorly preserved for detailed anatomical examination, is apparently built of leaves of some conifer.—*from* Author's abstract

11194 **Matsumoto, Tatsuro.** A Cretaceous ammonite from the island of Curaçao, Netherlands Antilles: Kyushu Univ. Fac. Sci. Mem., Ser. D, Geology, v. 17, no. 3, p. 277–286, illus., 1966.

The first ammonite from Curaçao, West Indies, here described as *Parapuzosia* n.sp.(?) aff. *P. daubreei*, was found in west central Curaçao in the Mameter Formation, upper Campanian or Maestrichtian, during study of stratigraphy of the Upper Cretaceous to lower Tertiary eugeosynclinal sequence by D. J. Beets (appendix to this paper, ibid., p. 287–294, 1966). The ammonite, a deformed imprint with suture hardly visible, closely resembles the type species from the Santonian of France, and also *P. boesei* from the Campanian of Mexico and Texas. The desmoceratid genus *Parapuzosia* is diagnosed. *P. (Austiniceras)* is considered a distinct genus, some species are revised, and distinctions from *Mesopuzosia*, *Pachydesmoceras*, *Pachydiscus* are discussed.—VMJ

02406 **Matten, L. C.; Banks, H. P.** Relationship between the Devonian progymnosperm genera *Sphenoxylon* and *Tetraxylopteris*: Torrey Bot. Club Bull., v. 94, no. 4, p. 321–333, illus., table, 1967.

The genus *Sphenoxylon* Read was erected for a single petrified axis collected in Upper Devonian marine strata in central New York, and *Tetraxylopteris* Beck for complex sterile and fertile branching systems abundantly preserved as compressions in lower Upper Devonian continental deposits in eastern New York. More recent collections, reexamination of older specimens, and reinterpretation of the structure of *Sphenoxylon* suggest that the two names refer to parts of one plant. We retain *Sphenoxylon* as a form genus for isolated petrifactions of mature axes and *Tetraxylopteris* as a natural genus for compressions of branching systems. Stratigraphic range of *Sphenoxylon* is here extended into Middle Devonian; branching of vascular supply to the ultimate appendages of *Tetraxylopteris* is demonstrated.—*from* Authors' abstract

11212 **Matten, Lawrence C.; Banks, Harlan P.** *Triloboxylon ashlandicum* gen. and sp. n. from the Upper Devonian of New York: Am. Jour. Botany, v. 53, no. 10, p. 1020–1028, illus., 1966.

The new taxon, from the Oneonta Formation in the northern Catskills, is represented by petrifactions showing two orders of branching. The main axis bears branches spirally and the ultimate appendages, borne spirally, branch dichotomously twice in one plane. Primary xylem of the main axis and branches is three armed with mesarch protoxylem extending in a continuous band within each arm. Primary xylem of the ultimate appendages is terete and dichotomizes twice. Metaxylem elements are characterized by scalariform and circular bordered pitting on all walls. The cortex is composed entirely of isodiametrical parenchyma cells. *Triloboxylon* is compared with other genera with three-lobed protosteles. Its possible affinity with the Aneurophytales is shown, and the possibility that the group possesses the morphological equivalent of simple leaves discussed.—*from* Authors' abstract

02141 **Matter, Albert.** Tidal flat deposits in the Ordovician of western Maryland: Jour. Sed. Petrology, v. 37, no. 2, p. 601–609, illus., table, 1967.

The lower part of the New Market Limestone (lower Middle Ordovician) was studied in the Wilson Quarry east of Clear Spring, Maryland. It was subdivided according to bedding into six types: laminated dolomite, ribboned, lumpy, stromatolitic, intraclastic, and bioclastic dolomitic limestones which are closely interbedded. Sediment filled and smaller spar filled mud cracks were found throughout the section, indicating that most of it accumulated above mean low water level. The six rock types are believed to represent sub-environments within the gross inter-supratidal environment: 1) marsh: lumpy limestones, 2) supratidal: laminated dolomite, 3) intertidal: ribboned and stromatolitic limestones.—Author's abstract

02233 **Matthews, William H., 3d.** Geology made simple—A comprehensive course for self study and review: Garden City, N. Y., Doubleday and Co., 192 p., illus., tables, 1967.

The book is divided into two parts, the first dealing with physical geology, and the second with historical, and is designed for self-study or review. The 13 chapters in Part 1 include an introduction to the Earth; minerals; igneous rocks and volcanism; metamorphism and crustal deformation; the geologic agents, water, glaciers, wind, and gravity; oceans and shorelines; and earthquakes and the Earth's interior. Part 2, six chapters, includes origin and age of the Earth; the record of the rocks; life of past ages; evolution; Earth history; and man. Four appendixes cover rock, mineral, and fossil collecting; a synopsis of plant and animal kingdoms; a glossary; and suggestions for further reading.—ESL

11219 **McAndrews, John H.** Postglacial history of prairie, savanna, and forest in northwestern Minnesota: Torrey Bot. Club Mem., v. 22, no. 2, 72 p., illus., tables, 1966.

Vegetation of a west-east transect of 11 townships, including Itasca State Park, was mapped as a west-east succession of Prairie, Oak Savanna, Mesic Deciduous Forest, and Pine-Hardwood Forest formations, corresponding with gradients of climate, soil texture, and fire frequency. The mapped vegetation was compared with pollen spectra of short cores from 11 ponds. The postglacial history of the vegetation formations is reconstructed with the aid of pollen diagrams of long cores from four ponds, diagrams representing the past 12,000 years. Absolute dating of the chronosequence is aided by five radiocarbon dates. The vegetation succession is thought to have been basically caused by climatic change acting on the available flora. The period 8,500–4,000 years ago was a time of higher temperature and greater aridity than the preceding and succeeding periods.—*from* Author's abstract

02257 **McCabe, H. R.** Tectonic framework of Paleozoic formations in Manitoba: Canadian Mining and Metall. Bull., v. 60, no. 663, p. 765–774, 1967.

The study of a detailed series of structure and isopach maps of the Paleozoic strata of southwestern Manitoba indicates that the principal Paleozoic tectonic elements have been modified to a considerable extent by major tectonic features of the Precambrian basement. The principal basement feature is the break between the Churchill and Superior provinces, which coincides roughly with the Manitoba-Saskatchewan border. East-west-trending orogenic belts within the Superior crustal block may also be reflected to some extent in later Paleozoic movements.—Author's abstract

McCormick, A. *See* Murphy, Mary T. J. 02184

McCrady, Allan D. *See* Guilday, John E. 02086

McGill, Peter. *See* Craig, James. 02300

11201 **McGrain, Preston; Dever, Garland R., Jr.** Geology of cement raw materials in Kentucky, *in* Symposium on geology of cement raw materials—Forum on geology of industrial minerals, 2d, 1966, Proc.: Bloomington, Ind., Indiana Geol. Survey and Indiana Univ., p. 31–44, illus., tables [1966?].

Cement raw materials are widely distributed and in close proximity to transportation. Investigations have disclosed large quantities of low-magnesium limestones in the eastern, central, and western parts of Kentucky. Principal sources are the limestones of Chesterian and Meramecian age. Less extensive deposits have been recognized in Trenton limestones. Investigations of ceramic materials have indicated large reserves of clays and shales which could be used by the cement industry; deposits are widely distributed and range in age from Silurian to Quaternary. Accessory ingredients which might be used by the cement industry, such as gypsum, anhydrite, silica, and iron, are also present. The statewide geologic mapping program is providing a useful tool for exploration of cement raw materials, and has resulted in discovery of new deposits.—*from* Authors' abstract

02256 **McMaster, Robert L.** Compactness variability of estuarine sediments—An *in situ* study, *in* Estuaries (edited by George H. Lauff): Am. Assoc. Adv. Sci. Pub. 83, p. 261–267, illus., tables, 1967.

In compression studies of various sediments, each sediment type, regardless of season, has a characteristic curve determined by textural and compositional properties. In plotting pressure against time there is a decreasing average slope with decreasing sand content. Viscosity of the water does not appear to be a major factor. Recent findings corroborate the supposition that biological and chemical activities are accelerated with heat, retarded with cold. In a Rhode Island section of Narragansett Bay sediments, the compactness variability follows a cycle which begins with open packing when bottom waters are warmer than 8°–10°C and biological and chemical processes more active. Below 5°–3°C the activities are retarded, particles more closely packed; in response to winter the transition temperature range may be 8°–3°C, whereas in spring it may be confined to 5°–10°C.—GDC

McMullen, R. M. *See* Swift, D. J. P. 01942

02019 **McMullen, R. M.; Swift, D. J. P.** An occurrence of large-scale rhomboid ripples, Minas Basin, Nova Scotia: Jour. Sed. Petrology, v. 37, no. 2, p. 705–706, illus., 1967.

Origin of the ripple-marks is not clearly understood, but is believed to result from simultaneous emergence of the whole sand bar with resulting run-off of surface and pore water.—RAC

Melcher, G. C. *See* Hurley, P. M. 02043

Melson, William G. *See* Luyendyk, Bruce P. 01971

Meneley, Robert. *See* Craig, James. 02300

01960 **Merida, Jesse E.; Boardman, Richard S.** The use of Paleozoic Bryozoa from well cuttings: Jour. Paleontology, v. 41, no. 3, p. 763–765, illus., 1967.

Study of Bryozoa from well cuttings from the Bromide Formation, Middle Ordovician, of southern Oklahoma, indicates that the phylum has potential use in subsurface stratigraphy. A total of 339 bryozoan fragments were recovered from 300 feet of section in one well. Using new techniques designed to handle small fragments of colonies, 70 percent are identifiable at the generic level and 48 percent are identifiable at the species level.—Authors' abstract

02272 **Merriam, Daniel F.; Sneath, Peter H. A.** Comparison of cyclic rock sequences using cross-association, *in* Essays in paleontology and stratigraphy—R. C. Moore Commemorative Volume: Kansas Univ. Dept. Geology Spec. Pub. 2, p. 523–538, illus., tables, 1967.

Cyclothems are compared from one sequence to another by matching strings of nonnumeric data—this process is loosely known as correlation. Cross-association is the statistical comparison of qualitative properties (nonnumeric data such as rock type and fossil content); cross correlation is the comparison of quantitative properties (numeric data, any type of measurement). The advantage of cross association in studying rock sequences is the relative ease with which many different kinds of properties can be combined. Three cyclic sedimentary sequences from the Upper Pennsylvanian of eastern Kansas were compared with an age equivalent sequence in central England, using a standard code of six letters for lithology of the ideal cyclothem. Each section was compared with each other to obtain a similarity index. Chi square was also calculated for the difference between observed and expected matches. Results confirmed the visual interpretations.—VMJ

11150 **Meyboom, Peter.** Current trends in hydrogeology: Earth-Sci. Rev., v. 2, no. 4, p. 345–364, illus., 1966.

The two current trends in hydrogeology are the "inward" look and the "outward" look. The inward look is directed principally at the very fundamentals of flow in porous media. It involves the re examination and extension of Darcy's law, as well as attempts towards unification of the microscopic and macroscopic viewpoints. The outward look is aimed at large conceptions of groundwater flow: hydrodynamic flow systems, hydrochemical flow systems, and hydrothermal flow systems. These two trends seem to be developing more or less independently, a fact that may reflect a basic difference in training and inclination of the scientists involved. However, there is no doubt about the ultimate union of these two trends.—*from* Author's abstract

Mielke, James E. *See* Long, Austin. 02223

02250 **Miller, Charles N., Jr.** Evolution of the fern genus *Osmunda*: Michigan Univ. Mus. Paleontology Contr., v. 21, no. 8, p. 139–203, illus., tables, 1967.

Recent work on the comparative anatomy of the living Osmundaceae has made it possible to define and distinguish between the three genera of the family and between the three subgenera of *Osmunda* using features contained in rhizomes and their adhering roots and petiole bases. Although it has not been possible to trace the origin of any of the subgenera to specific forms of *Osmundacaulis*, the subgenera *Osmunda and Osmundastrum* show greatest affinity with the *Osmundacaulis herbstii* group while *Plenasium* probably arose from an unknown form of the *Osmundacaulis skidegatensis* group. To recognize the probability that the genus *Osmunda* is polyphyletic and that its subgenera have been independent lines of specialization for at least 70 million years, it is recommended that *Osmunda, Osmundastrum, and Plenasium* be raised to genera.—*from* Author's abstract

02146 **Milliman, John D.** Carbonate sedimentation on Hogsty Reef—A Bahamian atoll: Jour. Sed. Petrology, v. 37, no. 2, p. 658–676, illus., tables, 1967.

Hogsty Reef is a small Bahamian atoll, with a distinct peripheral reef, a shallow lagoon, and a pronounced leeward pass. Wind driven currents move rapidly through the lagoon, so that the residence period of water is too short for noticeable change in salinity or temperature. Sediments at Hogsty Reef are: sand and gravel, derived from the peripheral reef; cay sand, also derived from surrounding reefs; and lagoonal sediment. The latter, the most abundant type, is mainly composed of 'non skeletal' fragments which increase westward in the lagoon; as currents become more rapid, skeletal components become fewer and the rate of sediment accumulation decreases. Non skeletal components are hypothesized to be primarily inorganically precipitated. It is suggested that in tropical waters, high current energy may be the critical condition necessary for inorganic precipitation of calcium carbonate.—*from* Author's abstract

02368 **Mining in Canada.** Geological study can help the potash mining operator: Mining in Canada, p. 21–23, July 1967.

Potash deposits of Saskatchewan are in beds of the Elk Point Group of Middle Devonian age. Potash occurs in the upper 200 feet of the Prairie Evaporites in several beds interlayered with halite. Carnallite masses of irregular outline occur abruptly at the limits of sylvite beds and in some places sylvite beds grade laterally to halite bodies. In some areas sylvite was formed from carnallite. Geophysical methods sometimes can outline different bodies of salts.—ARK

11173 **Mitchell, Robert.** Exploring for cement raw materials in developing countries, *in* Symposium on geology of cement raw materials—Forum on geology of industrial minerals, 2d, 1966, Proc.: Bloomington, Ind., Indiana Geol. Survey and Indiana Univ., p. 155–162, illus., table [1966?].

Using the seismic refraction and resistivity techniques, a few men can make surveys reaching to depths of 100 feet and covering large areas in a short time. Data obtained can be used to plan intensive drilling and sampling programs. Much of the knowledge of shallow depth geology has been developed from early geological surveys. Advanced drilling techniques and aerial photography can aid geologists in their search, but are costly and time consuming. New seismic refraction and

resistivity techniques have the advantages of speed and low cost in locating areas of high-potential subsurface resources, and eliminating areas of no potential so that future urban development can take place.—*from* Author's abstract

Mock, S. J. *See* Rinker, J. N. 02016

Monroe, Eugene A. *See* Sass, Daniel B. 02240

02083 **Monroe, Watson H.** The karst features of northern Puerto Rico [abs.]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 103, 1967.

11121 **Moody, J. D.** Crustal shear patterns and orogenesis: Tectonophysics, v. 3, no. 6, p. 479–522, illus., 1966.

Analysis of major crustal shears of North America, Europe, and Africa reveals the two world wide orthogonal compressional shear sets, essentially as wrench-fault zones. Meridional and equatorial compressive stresses, believed responsible for the systems, have led to crustal fragmentation into polygonal blocks. Localization of temperature and pressure increases with movement on the shear zones has resulted in mobilization of crustal material which is manifested in five types of tectonics and in related magmatism and metamorphism. Continental drift may occur by translation of polygonal crustal blocks above a discontinuity, possibly the same as or deeper than the M discontinuity, but over a more mobile, fundamentally basaltic subcrust. Interaction of fragmented crustal blocks under lateral compression results in orogenesis, oceanization, and continentization of the crust.—VSN

02375 **Moore, J. G.** Base surge in recent volcanic eruptions: Bull. Volcanol., v. 30, p. 337–363, illus., 1967.

A base surge, first identified at the Bikini undersea nuclear explosion, is a ring-shaped basal cloud that sweeps outward as a density flow from the base of a vertical explosion column. Base surges are also common in shallow underground test explosions, formed by expanding gases. They are a common feature of many recent shallow submarine and phreatic volcanic eruptions. They transport ash, mud, lapilli, and blocks with great velocity and commonly sandblast and knock down trees and houses, coat the blast side with mud, and deposit ejecta at distances beyond the limits of throw-out trajectories. Close to the eruption center, the base surge can erode radial channels and deposit material with dune type bedding.—*from* Author's abstract

Moore, Samuel L. *See* Jones, William R. 02045

02267 **Morgan, G. C.; Harris, M. C.** Portage Mountain dam—[Pt.] 2, Materials, *in* Canadian Soil Mechanics Conf., 19th, 1966, [Pt.] 2: Canadian Geotech. Jour., v. 4, no. 2, p. 142–166, 181–183, illus., tables, 1967.

The Portage Mountain dam in British Columbia will rank among the highest and largest earthfill dams in the world, containing about 57.7 million cubic yards of fill, and having a height of 600 feet. A moraine gravel with an appreciable silt content was selected to construct all zones in the dam. A total of 83 exploratory drill holes was put down in the moraine and continuous samples were taken. Engineering properties are discussed and shown in graphs and tables, and changes made in design as construction progressed are described. Performance of the partially completed dam is in accord with results of laboratory testing.—ESL

02353 **Morgan, J. H.** Pumping test of an Eocene aquifer near Mayfield, Kentucky: Kentucky Geol. Survey, ser. 10, Inf. Circ. 15, 20 p., illus., tables, 1967.

This report is concerned with a brief description and practical application of one of the analytical methods used in the quantitative appraisal of a 250 ft thick Eocene aquifer near Mayfield, Ky. The effects of pumping a well at a constant rate of 96 gpm for about 24 hours were recorded at three nearby wells and the results used to compute the coefficients of transmissibility and storage of the aquifer. The Jacob method of analysis gave average values of 300,000 gpd/ft for the transmissibility and 0.0002 for the storage. These results indicate the water is under

artesian conditions and the aquifer is not receiving any significant amount of downward recharge in the immediate area of the test site. Most recharge takes place laterally. —*from* Author's abstract

02155 **Morgan, James P.** Ephemeral estuaries of the deltaic environment, *in* Estuaries (edited by George H. Lauff): Am. Assoc. Adv. Sci. Pub. 83, p. 115–120, illus., 1967.

The term estuary, not usually applied to transitional coastal conditions such as in deltas, is here considered as any coastal embayment periodically affected by brackish oceanic waters. Three distinct estuarine types can be recognized near major river deltas, such as in the Mississippi and Ganges Brahmaputra systems. All deltaic estuaries result from delicate balance between coastal progradation, retreat under wave attack, and variations in sea level; in the present near stability, minor subsidence by compaction or downwarping can lead to their formation. Tidal currents modify deltaic physiography by channel erosion and interdistributary deposition, masking or obscuring estuarine types of the low tidal environment. Geologically ephemeral, deltaic estuaries in recorded human history involve significantly complex changing environments. —GDC

01979 **Morris, Donald E.** Occurrence and quality of ground water in Archer County, Texas: Texas Water Devel. Board Rept. 52, 57 p., illus., tables, 1967.

Archer County is in the outcrop area of upper Pennsylvanian and lower Permian strata in north central Texas. Usable ground water is generally limited to zones of the upper Pennsylvanian Cisco Group in the southeast quarter; in other areas, usable ground water is of erratic occurrence at shallow depths in the lower Permian Wichita Group. Comparison of chemical analyses shows that water generally increases in mineralization with increasing well depth. High chloride concentrations in water from some wells do not coincide with normal depth variation, or with usual quality of water produced by other wells in the same areas. Methods of disposal of oil field brine account for some impairment of quality. Reported brine production for 1961 was over 38 million bbl; 99 percent was reportedly returned to the subsurface through injection and disposal wells. —*from* Author's abstract

02171 **Mott, R. J.; Prest, V. K.** Stratigraphy and palynology of buried organic deposits from Cape Breton Island, Nova Scotia: Canadian Jour. Earth Sci., v. 4, no. 4, p. 709–724, illus., tables, 1967.

Pollen analysis of four non glacial, sub till deposits yielded pollen assemblages indicative of climates cooler than the present in the area. New radiocarbon dates from Hillsborough (>51,000 years), Bay St. Lawrence (>38,300 years), and Whycocomagh (>44,000 years) place these deposits in pre classical Wisconsin time. The Hillsborough and Whycocomagh deposits are considered to be time equivalent based on pollen analysis. A lack of distinct assemblages at Bay St. Lawrence and Benacadie prohibits correlation with one another and with the Hillsborough and Whycocomagh beds. Inferences drawn from pollen flora and stratigraphy indicate an early Wisconsin interstadial age for these deposits rather than a Sangamon interglacial. They are tentatively correlated with the St. Pierre interstade in Quebec. —*from* Authors' abstract

01973 **Mount, J. Russell; Rayner, Frank A.; Shamburger, Victor M., Jr.; Peckham, Richard C.; Osborne, Fred L., Jr.** Reconnaissance investigation of the ground water resources of the Colorado River basin, Texas: Texas Water Devel. Board Rept. 51, 107 p., illus., tables, geol. maps, 1967.

The Colorado River basin covers approximately 40,440 sq mi; the area of this study includes all or parts of 64 counties and represents about 15.3 percent of Texas' land surface. Primary aquifers, Ogallala and Edwards Trinity, are capable of supplying large quantities of water over large areas; secondary aquifers (Edwards Trinity, Santa Rosa, Ellenburger San Saba, Hickory, Gulf Coast, and Carrizo Wilcox), can supply large quantities over relatively small areas; numerous others have small to moderate yields locally. From 30 50 million acre feet of suitable quality ground water is available from storage. Of approximately 820,000 acre feet pumped from aquifers in 1960, about 690,000 was from the Ogallala. In areas

of heavy pumping, water levels are declining in the Ogallala and Edwards Trinity (Plateau) aquifers.—*from* Authors' abstract

Mountjoy, E. W. *See* Roed, M. A. 02163

Mousseau, R. J. *See* Zarrella, W. M. 02039

02065 **Muffler, L. J. Patrick.** Stratigraphy of the Keku Islets and neighboring parts of Kuiu and Kupreanof Islands, southeastern Alaska: U.S. Geol. Survey Bull. 1241 C, p. C1–C52, illus., tables, geol. map, 1967.

At least 15,000 feet of Late Silurian to Tertiary fossiliferous rocks are exposed at the north end of Keku Strait. The exposures consist of Upper Silurian Bay of Pillars Formation and Kuiu Limestone overlain by red arkose and volcanic graywacke and argillite; Devonian Gambier Bay Formation and a brown limestone; Mississippian(?) limestone; Mississippian and Pennsylvanian Saginaw Bay Formation; Permian Halleck, Cannery, and Pybus Formations; Upper Triassic Keku Volcanics and the Hyd Group of conglomerate, limestones, and volcanics; Jurassic and Cretaceous Seymour Canal Formation, Cretaceous plutonic intrusions; lower Tertiary continental sedimentary and felsic volcanic rocks; and middle Tertiary(?) gabbro intrusion.—LLP

02151 **Müller, German.** A pocket microscope for grain size measurement in the field: Jour. Sed. Petrology, v. 37, no. 2, p. 703–704, illus., 1967.

A pocket microscope with a special reticle pattern for measuring grain size, thickness of laminae, angle of foreset beds and others in the field is described.—Author's abstract

02397 **Müller, Klaus J.; Clark, David L.** Early Late Devonian conodonts from the Squaw Bay Limestone in Michigan: Jour. Paleontology, v. 41, no. 4, p. 902–919, illus., tables, 1967.

Cephalopods and conodonts confirm the correlation of the Squaw Bay Limestone with the lower part of the New Albany Shale in Indiana, the Independence Shale in Iowa, the Martin Limestone in southern Arizona, and the upper part of the Flume Dolomite of Alberta. The conodont fauna consists of 15 genera and 30 species; more than half the conodont specimens are of *Polygnathus*. The scarcity of *Icriodus* suggests that environmental factors were more important for conodonts than has normally been considered. Regeneration and growth patterns are described.—RCD

Münnich, K. O. *See* Zimmerman, U. 01925

11157 **Murphy, Leonard M.** An international tsunami warning system for the Pacific, *in* United Nations Regional Cartographic Conf. for Asia and Far East, 4th, Manila, 1964—V. 2, Proc. and Tech. Papers: New York, United Nations, p. 170–172, illus., 1966.

The Pacific warning system established in 1948 by the U.S. Coast and Geodetic Survey, with field headquarters in Honolulu, was not the first such tsunami warning system but does protect countries around the perimeter and the many islands of this vast ocean. It consists of a network of seismograph stations to furnish data for locating earthquake epicenters, a network of tide stations for evaluating tsunami potential, seismic sea wave traveltime charts, and a high priority communications system. Honolulu will assume responsibility for participating countries within 1,000 miles or more of the earthquake center. Continual expansion of service includes improving speed of recognition of focal mechanisms that generate tsunamis.—GDC

02184 **Murphy, Mary T. J.; McCormick, A.; Eglinton, G.** Perhydro β-carotene in the Green River Shale: Science, v. 157, no. 3792, p. 1040–1042, illus., 1967.

Several triterpenes and the tetraterpene perhydro β-carotene have been identified in the branched cyclic hydrocarbon fraction of this Eocene shale. The analytical procedure included thiourea adduction followed by combined gas chromatography and mass spectrometry.—Authors' abstract

02208 **Murray, David F.** Gravel mounds at Rocky Flats, Colorado: Mtn. Geologist, v. 4, no. 3, p. 99–107, illus., 1967.

On the coarse alluvium of the Rocky Flats pediment, randomly spaced mounds of sorted gravel occur upon a pavement of cobbles and small boulders. The mounds are elliptical in plan view and symmetrical in cross section. Average length is 42 feet, average width 38 feet and average height at the center is 9.6 inches. Mound form, sorting of gravel and subsidence of pavement beneath the mounds are attributed to the tunneling activity of pocket gophers. Stresses of a brief period of saturated soil during spring snowmelt stimulate mound construction by the gophers. Territorial behavior of the gopher is responsible for the mound pattern and size limits.—Author's abstract

11131 **National Academy of Sciences.** (Committee on Rock Mechanics). Rock mechanics research—A survey of United States research to 1965, with a partial survey of Canadian universities: Natl. Acad. Sci.—Natl. Research Council Pub. 1466, 82 p., illus., tables, 1966.

This committee was formed to determine the current status of research and of technical training in rock mechanics in the United States, to point out strengths and deficiences, and to make recommendations to guide future development. The report summarizes academic education and research, and industrial and federal research, with recommendations and conclusions. Appendix information includes conferences on rock mechanics, publications used for teaching, theses by school through 1965, theses and government projects categorized by scope, and government research projects from 1963–66. A list of research needs related to highways will be published in more extensive form as a Highway Research Circular.—MCM

Neal, William J. *See* Hubert, John F. 02232

01951 **Neale, John W.; Schmidt, Ruth A. M.** On *Normanicythere leioderma* (Norman) and *Normanicythere concinella* Swain: Micropaleontology, v. 13, no. 3, p. 345–350, illus., 1967.

Re examination of available material suggests that for the time being these Quaternary ostracodes may be regarded as separate species characteristic of both Alaska and the North Atlantic.—ESL

01910 **Neathery, Thornton Lee.** Paragenesis of the Turkey Heaven Mountain kyanite deposits, Cleburne County, Alabama: Alabama Geol. Survey Circ. 41, 56 p., illus., geol. maps, 1967.

This area, southeast of Heflin, is underlain by the Ashland Mica Schist and Wedowee Formation, Precambrian to early Paleozoic(?) in age; the metamorphic isograd is equivalent to the greenschist facies. The dominant structural feature of Turkey Heaven Mtn. is the sigmoidal trend of schistosity superimposed on overturned isoclinal folds, with secondary disharmonic folding in the basal part of the Wedowee Formation and strong primary foliation, crenulation, and sets of joints. Kyanite was observed along foliation planes, and paragonite pseudomorphs after kyanite where deformation was most severe, both with intermixed saccharoidal and massive quartz. The kyanite was formed under stress or deposited from hydrothermal solutions. Subsequent deformation altered the physicochemical system of mineral assemblage.—GDC

11160 **Nelson, J. H.; Campbell, Joel B.** Geomagnetic instrumentation and Data Centre activities, *in* United Nations Regional Cartographic Conf. for Asia and Far East, 4th, Manila, 1964—V. 2, Proc. and Tech. Papers: New York, United Nations, p. 117–122, illus., 1966.

At the present time the United States Coast and Geodetic Survey is operating eleven geomagnetic observatories in the United States and its territories and three in Antarctica, in cooperation with the United States Antarctic Research Program. Instrumental equipment includes the Proton Vector Magnetometer and Automatic Standard Magnetic Observatory, discussed herein, along with technical improvements in the program. Report is made on World Data Centre A, established

in the United States in 1957, which is one of three having a complete set of geomagnetic, seismologic, and gravity data available for study by scientists of various disciplines.—GDC

11125 **Neumann, Frank.** Principles underlying the interpretation of seismograms: U.S. Coast and Geod. Survey Spec. Pub. 254 (revised edition), 50 p., illus., tables, 1966; originally published 1951.

Few textbooks on seismology have covered the interpretation of earthquake seismograms in sufficient detail; this publication is designed to fulfill this need for the seismograph station director, the student beginning his career as a seismologist, or the amateur. The fundamental background includes information pertaining to the origin and transmission of seismic waves, Earth structure and nature of the transmitting medium, the recording characteristics of the principal types of seismographs now used in the long-range detection of earthquakes, and the distinction between routine interpretation and research.—GDC

02001 **Newby, Jerry B.** George Franklin Buttram (1886–1966): Am. Assoc. Petroleum Geologists Bull., v. 51, no. 7, p. 1368–1369, portrait, 1967.

02285 **Newell, Norman D.** Paraconformities, *in* Essays in paleontology and stratigraphy—R. C. Moore Commemorative Volume: Kansas Univ. Dept. Geology Spec. Pub. 2, p. 349–367, illus., 1967.

It is concluded that paraconformities are regional biostratigraphic, not recurring datums that mark sedimentary interruptions of significant temporal magnitude. Profound vertical changes in biofacies may also result from environmental changes, but such changes tend to be oscillatory and produce lateral interfingering of facies. By definition, paraconformities follow bedding planes on which there is a lack of convincing physical evidence of erosion. Paraconformities may merge laterally with disconformities [lithostratigraphic erosional breaks in parallel sequences] or they may represent significant episodes of net bypassing of subaqueous sediments. Many of their characteristics are puzzling and merit intensive field and laboratory studies.—Author's summary

11218 **Newton, J. G.; Powell, W. J.; Golden, H. G.; Avrett, J. R.** Water av[illegible]ility, Barbour County, Alabama: Alabama Geol. Survey Map 34, scale about 1 in. to 1 1/7 mi., text, 1966.

The most productive aquifer in Barbour County is the Cretaceous Tuscaloosa Group sands which yield as much as 500 gpm in the northern two thirds of the county. Tables show all geologic units and their water bearing characteristics, records of wells and springs, and chemical analyses of water from wells and springs. Inset maps indicate depth to aquifer that will yield water for domestic supply, distribution of hardness of water from the Clayton Formation, distribution of iron content of water from the Nanafalia Formation, and from the upper unnamed member of the Providence Sand. Additional information concerns surface water.—MCM

02331 **Nichols, L.** Field investigations for opencast iron mines in Quebec and Labrador, Canada [abs.]: Geol. Soc. London Proc. 1965–66, no. 1641, p. 159–160, 1967.

02189 **Nichols, M. M.; Ellison, R. L.** Sedimentary patterns of microfauna in a coastal plain estuary, *in* Estuaries (edited by George H. Lauff): Am. Assoc. Adv. Sci. Pub. 83, p. 283–288, illus., tables, 1967.

To show relation of microfauna to environment of deposition and to certain processes of sedimentation, 225 quantitative core samples of surface sediment were studied from 148 stations in the estuary and marshes of the Rappahannock Estuary, Va. There are three microfaunal biofacies in the estuary corresponding to three water types: river subfacies with Thecamoebina in the freshened part; shoal subfacies containing arenaceous Foraminifera in the upper layer and downstream; basin subfacies of calcareous Foraminifera in the lower, deeper water. A few Ostracoda penetrate the fresh upper reaches and tributary creeks. Distribution of empty tests parallels that of living specimens, but reworking and redistribution of tests by the

various currents may be significant. Contrast is made with patterns of Mississippi Sound and a Texas lagoon.—GDC

02228 **Nicolay, H. H.; Stone, A. V.** Rocks and minerals—A guide for collectors of the eastern United States: New York, A. S. Barnes and Co., 255 p., illus., 1967.

This book gives a brief description of the economic geology of each of the eastern states, locations and directions for mines and mineral localities, and a list of nearby accomodations and camping areas. Also included are a section on lapidary equipment and a bibliography of books on rocks and minerals, fossils, and geologic history.—LLP

01929 **Nir, A.** Geophysical aspects of the search for the quark: Phys. Rev. Letters, v. 19, no. 6, p. 336–339, illus., 1967.

The suitability of natural media to serve as objects for quark abundance are discussed; included are the effects of momentum distribution at production, concentration or dilution in collection, effective length of irradiation by cosmic radiation, and target shape. The resulting concentrations may vary by ten orders of magnitude, the lowest being for sea water, the highest for stratospheric aerosols and selected iron meteorites.—*from* Author's abstract

02345 **Noakes, John; Kim, Stephen; Akers, Lawrence.** Recent improvements in benzene chemistry for radiocarbon dating: Geochim. et Cosmochim. Acta, v. 31, no. 6, p. 1094–1096, table, 1967.

Benzene radiocarbon dating is discussed in view of recent improved chemistry. A high yield benzene catalyst is described which eliminates concern for carbon isotope fractionation, benzene purity, and extensive sample preparation time.—Authors' abstract

02204 **Noakes, John E.; Kim, S. M.; Akers, L. K.** Oak Ridge Institute of Nuclear Studies radiocarbon dates I: Radiocarbon, v. 9, p. 309–315, 1967.

The Radiocarbon Dating Laboratory of the Oak Ridge Institute of Nuclear Studies was developed as a teaching and research facility in the Special Training Division. Descriptions are given for geologic samples from Shark Bay, Western Australia; Campeche Bank, Yucatan (Mexico); and Sapelo Island, Georgia.—MCM

Norford, B. S. *See* Aitken, J. D. 02301

11135 **Norford, B. S.** Ordovician and Silurian stratigraphy of southern Rocky Mountains of Canada [abs.], *in* Lower Paleozoic symposium: Bull. Canadian Petroleum Geology, v. 14, no. 4, p. 600–601, 1966.

02252 **Norris, A. W.** Descriptions of Devonian sections in northern Yukon Territory and northwestern District of Mackenzie: Canada Geol. Survey Paper 66–39, 298 p., 1967.

Twenty two Devonian sections measured by members of Operation Porcupine in 1962 are described, providing additional data to a preceding report on the Devonian stratigraphy of the northern Yukon Territory and adjacent area.—Author's abstract

Norris, M. S. *See* Zarrella, W. M. 02039

01922 **Norris, S. E.** Effects on ground water quality and induced infiltration of wastes disposed into the Hocking River at Lancaster, Ohio: Ground Water, v. 5, no. 3, p. 15–19, illus., 1967.

Low streambed permeability in the vicinity of the municipal well field, resulting from discharge of wastes to the Hocking River, seriously retards infiltration of surface water and lessens available yield. Brine and iron laden effluent from the municipal treatment plant discharge to a stream already carrying much organic waste and other debris. Indirect contamination of aquifers and adverse physical and chemical alteration of streambed sediments, resulting from surface water waste

disposal, may pose a threat to ground-water supply in many places.—*from* Author's abstract

Northcote, K. E. *See* White, William H. 02169

01909 **Nugent, L. E., Jr.** Critical analysis of stack seismic systems: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 6, pt. 1, p. 951–956, illus., 1967.

"Stack" seismic techniques that entail multiple shots or drops per spread have several limitations. Step-out corrections assuming a common depth point are correct only if the seismic line parallels the strike. Intermediate or high-angle dips result in serious distortion or cancellation of the reflection. Velocity changes in sedimentary section may affect stack techniques seriously. Stacking of reflections lowers the frequency and detracts from definitive characteristics. It is usually very difficult to obtain shallow data, and to map shallow formations. The stack system is not practical for obtaining the reflection data necessary for accurate migration.—WCC

02131 **Oakes, Malcolm C.** (and others). Geology and petroleum of McIntosh County, Oklahoma—Pt. 1, Geology and mineral resources of McIntosh County: Oklahoma Geol. Survey Bull. 111, p. 5–49, 68–88, illus., tables, geol. map, 1967.

In McIntosh County, an area of about 700 sq mi in eastern Oklahoma, the consolidated rock outcrops are mostly Pennsylvanian sands and shales. The only important unconformity is between the Krebs and Cabaniss Groups of the Des Moines Series. The rocks were formed from sediments derived mostly from the south, with minor amounts from the north. The surface structure of Boggy and older rocks in eastern McIntosh County is dominated by several westward-trending folds and faults. This structure probably extends beneath the Cabaniss Group in the western part of the county. The Quaternary system is represented by unconsolidated rocks, terrace deposits, and Recent alluvium. Numerous coal occurrences have been reported but only the Secor vein has been mined commercially. Sandstone and shale have economic potential. Also included are short descriptions of 117 measured sections.—LLP

01940 **O'Brien, Neal R.; Harrison, William.** Clay flake orientation in a sensitive Pleistocene clay: Maritime Sediments, v. 3, no. 1, p. 1–4, illus., 1967.

Electron micrographs of an illitic clay in the St. Lawrence River valley, near Massena, N. Y., offer additional evidence of the random orientation of clay flakes in sensitive clay. This orientation may have been produced by deposition of the clay in the flocculated state.—ESL

02143 **Odom, I. Edgar.** Clay fabric and its relation to structural properties in mid-continent Pennsylvanian sediments: Jour. Sed. Petrology, v. 37, no. 2, p. 610–623, illus., tables, 1967.

The relation of clay particle orientation to structural properties of argillaceous sediments is demonstrated quantitatively. Factors that might influence particle orientations and structural properties such as clay mineralogy, presence of organic material, and mineral carbonate content are investigated also.—VSN

02212 **Oeschger, H.; Riesen, T.** Bern radiocarbon dates VI: Radiocarbon, v. 9, p. 28–34, table, 1967.

This date list, consisting of some measurements made since the summer of 1965, includes samples from Greenland, Switzerland, Germany, Iran, and Sudan.—MCM

02221 **Ogden, J. Gordon, 3d; Hay, Ruth J.** Ohio Wesleyan University natural radiocarbon measurements III: Radiocarbon, v. 9, p. 316–332, 1967.

This list of dates is compiled from samples prepared since publication of OWU II (1965) and includes determinations through November 1966. Geologic samples (glacial geology) are from Ohio, Wisconsin, Iowa, and Greenland; geologic samples (lake and bog sedimentation) from Georgia, Ohio, Michigan, and New Jersey;

archeologic samples from Illinois, Pennsylvania, and Ohio; and check samples from Ohio, Massachusetts, and Indiana.—MCM

02239 **Ogilvie, R. T.; Baptie, B.** A permafrost profile in the Rocky Mountains of Alberta: Canadian Jour. Earth Sci., v. 4, no. 4, p. 744–745, 1967.

A soil profile in which a permanently frozen layer was present was found in the Front Ranges, Banff Natl. Park area, in Snow Creek Valley near the summit of the divide. It occurs on a steep, north-facing slope at 7,700 feet. Surficial material consists of loose, coarse colluvial rubble, through which seepage drainage occurs. At the time of greatest thaw, the frozen layer was at a depth of 15 inches. Temperature data from nearby stations in the valley show a mean annual value of 25°F.—ESL

Olsson, Richard K. *See* Berggren, William A. 01949

Oman, Charles L. *See* Ives, Patricia C. 02226

02013 **Opdyke, J. B.** The development of short-lived tracer sands for coastal studies [summ.]: Coastal Research Notes, v. 2, no. 4, p. 17–18, 1967.

01998 **Oppenheim, Victor.** Critique of hypothesis of continental drift: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 7, p. 1354–1360, 1967.

Observations of geodetic, geophysical, and geological conditions of continents and ocean floors indicate that the notion of continental drift is an over-simplification of the complex structural conditions of the Earth's crust. A more plausible interpretation of the causes of separation of continental masses, based on the patterns of global crustal fracture zones and continental fracture zones, would be expansion of the Earth's crust.—WCC

02040 **Orr, Wilson L.; Grady, John R.** Perylene in basin sediments off southern California: Geochim. et Cosmochim. Acta, v. 31, no. 7, p. 1201–1209, illus., tables, 1967.

The distribution of perylene in basin sediments off southern California is reported and described in terms of the depositional environments. It is suggested that this hydrocarbon is formed by reduction of perihydroxyperylenequinone pigments of biologic origin. The reduction to perylene takes place in anaerobic sediments after burial. The precursor quinones may be destroyed in oxidizing environments before burial in which case perylene may not be formed by later development of anaerobic conditions in the sediment.—Authors' abstract

Osborne, Fred L., Jr. *See* Mount, J. Russell. 01973

02145 **Osborne, Robert H.** The American Upper Ordovician standard—[Pt.] 8, R mode factor analysis of Cincinnatian limestones: Jour. Sed. Petrology, v. 37, no. 2, p. 649–657, tables, 1967.

An R mode factor analysis based on 20 petrographic variables observed in thin sections of 60 Cincinnatian biomicrosparrudites was performed to illustrate the geologic use of this statistical procedure. Five significant factors were extracted from a 20×20 correlation matrix, which account for 82 percent of the total variance. The geologic interpretations of the factors in order of decreasing statistical significance are: (1) mechanical energy gradient at the depositional site, (2) substrate firmness, (3) degree of lithification, (4) relative contributions of carbonate mud and skeletal grains to the sediment, and (5) Eh at or slightly below the depositional interface. Three limestone classes were compared with each factor, and the genetic relationships were obtained.—*from* Author's abstract

O'Shea, Donald C. *See* Shapiro, Stephen M. 02253

02000 **Owen, Edgar W.** Avary Hunt Alcorn (1902–1967): Am. Assoc. Petroleum Geologists Bull., v. 51, no. 7, p. 1368, portrait, 1967.

11205 **Ozol, Michael A.** Observations on the use of foliated rocks for coarse aggregate in paving concrete, *in* Symposium on geology of cement raw materials—Forum on geology of industrial minerals, 2d, 1966, Proc.: Bloomington, Ind., Indiana Geol. Survey and Indiana Univ., p. 111–128, illus., tables [1966?].

Petrography is applied in interpreting the mode of distress of certain platy rocks in concrete pavement. Investigation of flecking of a pavement led to the conclusion that the stone used, a granite gneiss, controlled the flecking by localizing stresses along the interface of oriented platy particles and their mortar cover. The mechanism, an apparent bond failure, is dependent on orientation of micas and the likelihood that the mica to mica bond is weaker than the mica to mortar bond. Another pavement showing aggregate scaling used a calc schist. A third rock, a slate, similar in mineralogy and fabric to the first two, has been recommended for concrete aggregate because petrographic study shows the fabric is different. Micas occur in thin stringers interwoven among quartz grains.—*from* Author's abstract

02359 **Page, Norman J.** Serpentinization at Burro Mountain, California: Contr. Mineralogy and Petrology, v. 14, no. 4, p. 321–342, illus., tables, 1967.

The Burro Mountain ultramafic complex, Monterey County, Calif., consists of dunites and peridotites partially or wholly serpentinized. Primary minerals in both rock types are olivine, enstatite, diopside, and picotite; alteration yields chrysotile, lizardite, brucite, magnetite, talc, tremolite, and carbonate. Electron microprobe analyses show that enstatite alters to "bastite" composed only of lizardite; olivine forms lizardite+chrysotile+brucite with or without magnetite. As serpentinization proceeds, products are enriched in FeO relative to MgO. Serpentinization probably originates in a changing P–T environment by two different reactions, presented herein. That temperatures of serpentinization may be lower than heretofore inferred is suggested by thermodynamic calculations, assuming ideal solid solution, and considering the stability field of brucite.—GDC

11213 **Paghis, Irvine.** The Earth's outermost atmosphere: Royal Astron. Soc. Canada Jour., v. 60, no. 6, p. 261–271, illus., table, 1966.

As the outermost atmosphere is conceived at present, at great heights there are two distinct noninteracting gaseous envelopes, one consisting of neutral and the other of charged particles. The high-altitude charged particles constitute an electrically neutral plasma which is embedded in a second plasma, the solar wind. Physical interactions between the two plasmas form relatively sharp boundaries. The magnetosphere boundary does not coincide with the boundary between the solar and terrestrial atmospheres, due to the high speed of the solar wind and resulting shock wave.—DBV

Pakiser, L. C. *See* Hill, D. P. 02229

11151 **Pakiser, L. C.; Robinson, Rhoda.** Composition and evolution of the continental crust as suggested by seismic observations: Tectonophysics, v. 3, no. 6, p. 547–557, illus., tables, 1966.

This is the same as the paper published *in* The earth beneath the continents—A volume of geophysical studies in honor of Merle A. Tuve: Am. Geophys. Union Geophys. Mon. 10 (Natl. Acad. Sci.—Natl. Research Council Pub. 1467), p. 620–626, illus., tables, 1966 (Abstracts of North American Geology, September 1967).—VSN

02082 **Palmer, Arthur N.** The survey and geologic investigation of Blue Spring Cave, Indiana [abs.]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 103, 1967.

02194 **Pantoja-Alor, Jerjes; Robison, Richard A.** Paleozoic sedimentary rocks in Oaxaca, Mexico: Science, v. 157, no. 3792, p. 1033–1035, illus., table, 1967.

Fossiliferous Cambrian, Ordovician, Mississippian, and Pennsylvanian rocks, never before found in southern Mexico, have been discovered in the Nochixtlan region. Superjacent unfossiliferous sedimentary rocks may be Permian in age. Early

Paleozoic and late Paleozoic intervals of marine sedimentation were bounded by intervals of positive tectonism and erosion.—Authors' abstract

Parker, B. C. *See* Dyck, L. A. 02390

02407 **Parker, B. C.; Dyck, L. A.** Comparisons of fossil and extant fructification of *Chara*—[Pt.] 1, Histochemistry and ultrastructure [abs.]: Jour. Phycology, v. 3, supp., p. 10, 1967.

02328 **Parker, Patrick L.** Fatty acids in Recent sediment: Contr. Marine Sci., v. 12, p. 135–142, illus., tables, 1967.

Fatty acids isolated from marine sediments of several environments were compared to acids isolated from marine plankton. An inventory of organic matter in sediments is contrasted with that in organisms. The geochemical significance of the branched-chain acids and the even-odd acid ratio is discussed. Several geologically early chemical transformations of fatty acids in sediments are pointed out.—Author's abstract

01959 **Parkhomenko, E. I.** Electrical properties of rocks (translated from Russian and edited by G. V. Keller): New York, Plenum Press, 314 p., illus., tables, 1967.

A comprehensive review of work done in recent years on the electrical properties of rocks and other earth materials is presented. It deals with the petrographic and geologic classification of rocks, the dielectric properties of rocks and minerals, the conductivity of such materials, and dielectric losses. Extensive tables of values for the properties of various rocks and minerals are included, and of particular importance is the careful analysis of the reliability and representativeness of these data. The book reviews the very extensive Russian work done in the field and also contains a complete description of research performed outside the Soviet Union.—*from* Author's abstract

Parkin, D. W. *See* Delany, A. C. 02341

02374 **Parsons, W. H.** Manner of emplacement of pyroclastic andesitic breccias: Bull. Volcanol., v. 30, p. 177–187, illus., 1967.

Andesitic pyroclastic volcanic breccias may be emplaced by vulcanian or phreatic explosive eruptions, by underground brecciation and subsequent breccia flows, and as massive lahars. It is shown that the second of these mechanisms has apparently been dominant in the Absaroka volcanic field of northwest Wyoming and southern Montana.—DBV

Pattison, E. F. *See* Philpotts, A. R. 02042

02007 **Paull, Richard A.** Geological vandalism—A growing threat to earth science education: Earth Sci., v. 20, no. 4, p. 169–172, illus., 1967.

Geological vandalism involves thoughtless and irresponsible acts by earth scientists and students while involved in field work and field training. This type of vandalism is occurring throughout the United States wherever classical areas are intensively studied. To illustrate the seriousness of this problem, examples of wanton sample collecting, senseless mutilation of outcrops by geology picks, spray painting of outcrops to aid certain lecturers, and scrawling of student and university names on rock surfaces are described from the Devil's Lake–Baraboo region of Wisconsin. If field work is to remain a part of earth science education, it will be necessary for all persons involved to correct their own faults and strive to instill respect for geology in the hearts, as well as in the minds, of their students. Only in this way can geological vandalism be eliminated.—*from* Author's abstract

Pawluk, S. *See* Bayrock, L. A. 02160

Pearson, F. J., Jr. *See* Valastro, S., Jr. 02224

02072 **Pearson, Robert C.** Geologic map of the Bodie Mountain quadrangle, Ferry and Okanogan Counties, Washington: U.S. Geol. Survey Geol. Quad. Map GQ-636, scale 1:62,500, sections, 1967.

02268 **Peck, Ralph B.** Discussion [of "Portage Mountain dam—Pt. 2, Materials," by G. C. Morgan and M. C. Harris, 1967], *in* Canadian Soil Mechanics Conf., 19th, 1966, [Pt.] 2: Canadian Geotech. Jour., v. 4, no. 2, p. 166–172, illus., 1967.

The author, having worked on the soil mechanics aspects of the dams on the Peace River project, British Columbia, in 1959, gives more detail than Morgan and Harris (ibid., p. 142–166) on the different fill possibilities for the Portage Mountain dam; resulting changes in design with further exploration ended with the decision to use the moraine.—ESL

Peckham, Richard C. *See* Mount, J. Russell, 01973

02055 **Perry, Kenneth, Jr.** An application of linear algebra to petrologic problems—Pt. 1, Mineral classification: Geochim. et Cosmochim. Acta, v. 31, no. 6, p. 1043–1078, illus., tables, 1967.

The algebraic structure of both mineral composition spaces and mineral groups is investigated. Classification principles are derived which are applicable to all mineral groups or mineral compositions regardless of the geometric complexity of the composition involved. The procedure of classification and composition is illustrated for the feldspar, biotite, and amphibole mineral groups.—DBV

11183 **Peters, LeRoy R.** Evolutionary trends of the *Mucrospirifer*: Wisconsin Acad. Sci., Arts, and Letters Trans., v. 55, p. 139–143, illus., 1966.

The Brachiopods *Mucrospirifer mucronatus and Mucrospirifer thedfordensis* from the Silica formation of the Devonian of Ohio were studied and were shown to be in the process of evolving from a compact form to a long narrow form and to two flattened varieties of the original form. Through this study of the *Mucrospirifer* of the Devonian of Ohio, the Devonian of Wisconsin may be more closely correlated with the Devonian of Ohio after a similar study.—*from* Author's abstract

Peterson, D. J. *See* Fitzgerald, E. L. 02305

01972 **Peterson, Donald W.** Geologic map of the Kilauea Crater quadrangle, Hawaii: U.S. Geol. Survey Geol. Quad. Map GQ-667, scale 1:24,000, section, text, 1967.

The southeastern part of the Kilauea Crater quadrangle contains the summit area of Kilauea Volcano, the northern and western part a portion of the eastern flank of Mauna Loa Volcano. All the lava is basaltic, pahoehoe and aa types are abundant, and pyroclastic deposits blanket much of the area near Kilauea caldera. Faults of the Koiki fault system on the lower Mauna Loa slopes are expressed chiefly by abrupt changes in slope. Many lava flows contain distinct channels. The description of the map units of Kilauea are in terms of eruption and overflow products from 1832–1961, spatter and lava cones, basalt, ash, and lavas; of Mauna Loa as products of the 1880 eruption, alluvium, lava, lava flows, and cinder cone.—MCM

01961 **Peterson, Gary L.** Lower Cretaceous stratigraphic discontinuity in northern California and Oregon: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 6, pt. 1, p. 864–872, illus., 1967.

Cumulative physical and faunal evidence that Aptian-Albian rocks rest unconformably upon Neocomian or pre-Cretaceous strata now indicates a regional mid-Early Cretaceous episode of deformation, nondeposition, and erosion. This discontinuity probably reflects a regional baselevel shift and accompanying diastrophism throughout the region, and perhaps well beyond. Establishment of an unconformity within the middle part of the Lower Cretaceous "Shasta series", south of Ono, and along the west side of the Sacramento Valley, Calif., separates this series into two subunits.—BHK

Peterson, Richard S. *See* Hoffmann, Robert S. 02126

02004 **Petrick, Glen.** Dan Wesley McCauley (1916–1967): Am. Assoc. Petroleum Geologists Bull., v. 51, no. 7, p. 1372–1373, portrait, 1967.

02314 **Petryk, Allen Alexander.** Some Silurian stromatoporoids from northwestern Baffin Island [abs.]: Bull. Canadian Petroleum Geology, v. 15, no. 2, p. 212, 1967.

01999 **Pettyjohn, Wayne A.** New members of Upper Cretaceous Fox Hills Formation in South Dakota, representing delta deposits: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 7, p. 1361–1367, illus., 1967.

In western South Dakota, the Fox Hills Formation is dominantly of continental origin and is here divided into two new members—the Fairpoint (below) and White Owl Creek. The upper unit of the Fairpoint is called the Stoneville coal facies. The Fox Hills here is probably the result of deltaic sedimentation.—WCC

02310 **Pezzetta, J. M.** Recent sediments of the Scotian Shelf [abs.]: Bull. Canadian Petroleum Geology, v. 15, no. 2, p. 210–211, 1967.

Phelps, D. S. *See* Knauer, G. A. 02213

02042 **Philpotts, A. R.; Pattison, E. F.; Fox, J. S.** Kalsilite, diopside and melilite in a sedimentary xenolith from Brome Mountain, Quebec: Nature, v. 214, no. 5095, p. 1322–1323, illus., 1967.

A large sedimentary xenolith in the Brome Mountain gabbro, metamorphosed to the sanidine facies, is described. Kalsilite ($KAlSiO_4$) is a major constituent of the xenolith, the first known occurrence of this rare mineral as a metamorphic product; melilite and diopside are also present. The evidence suggests that the original sediment was probably a feldspathic dolomite, and that the composition of the xenolith has been determined largely by the type of sedimentary rock involved rather than by metasomatism. To test this origin, a mixture of microcline and dolomite was sealed with a very large excess of water and held at 900°C at 10,000 lb per sq in. pressure for five days. The reaction went to completion and yielded diopside + kalsilite + CO_2.—DBV

Picard, Leo. *See* Serruya, Collette. 02150

02123 **Picard, M. Dane; Beckmann, Douglas D.** Non-opaque grain fabrics of siltstones in Red Peak Member (Triassic), central Wyoming—Reply to discussion [of 1966 paper] by A. I. Rees [1967]: Jour. Sed. Petrology, v. 37, no. 2, p. 712–714, illus., 1967.

Previously published conclusions (ibid., v. 36, p. 506–521) are based on a ninety percent confidence level. On this basis, contrary to Mr. Rees' opinion (ibid., v. 37, p. 710–711), the data constitute statistically significant evidence that opaque grain orientations in many strata were influenced by the magnetic field before lithification occurred.—RAC

Pinson, W. H., Jr. *See* Hurley, P. M. 02043

Pohl, E. R. *See* Quinlan, James F. 02091

02193 **Postma, H.** Sediment transport and sedimentation in the estuarine environment, *in* Estuaries (edited by George H. Lauff): Am. Assoc. Adv. Sci. Pub. 83, p. 158–179, illus., tables, 1967.

In sediment movement in nearshore waters, tidal flat areas, and estuaries, various transport mechanisms may be active which tend to hold the material within these regions; loss to offshore and deep waters seems less than expected. Settling and scour lag effects, combined with tidal movements, can lead to residual transport towards the coast; density differences may concentrate suspended materials in turbidity maxima. The retention is usually most effective for fine-grained matter, a grain size of between 100 and 5–10μ. Retention and sedimentation of fine-grained

matter are promoted by flocculation; scour lag effects are increased with time for consolidation. In many areas the distributional patterns are closely related to water movements, including waves, but grain size and concentrations of suspended matter are also important.—GDC

Potter, R. R. *See* Jambor, J. L. 02277

11128 **Powell, J. L.; Hurley, P. M.; Fairbairn, H. W.** The strontium isotopic composition and origin of carbonatites, *in* Carbonatites (O. F. Tuttle and J. Gittins, editors): New York, Interscience Publishers, p. 365–378, illus., tables, 1966.

Sr 87/Sr 86 ratios were measured in carbonatite and alkalic rocks at Oka, Quebec; Magnet Cove, Arkansas; and Spitzkop, Transvaal. Since the mean Sr ratio of 21 carbonatites analyzed is lower than the usual limestone Sr ratios, it is concluded that carbonatites are not xenoliths of limestone. The Sr ratios from the three complexes studied are identical to the associated alkalic rocks, supporting the hypothesis that the carbonatites and the alkalic rocks are comagmatic. From a comparison of the carbonatite and basalt Sr ratios, it is concluded that the homogeneity of the carbonatite source material is similar to that of the basalt. The Sr ratios of carbonatites are lower than those of sialic crust materials indicating that the carbonatite–alkalic rock association is derived from below the sial and possibly from below the Mohorovicic discontinuity.—LLP

Powell, W. J. *See* Newton, J. G. 11218

01996 **Powers, Maurice C.** Fluid-release mechanisms in compacting marine mudrocks and their importance in oil exploration: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 7, p. 1240–1254, illus., 1967.

Alteration of montmorillonite to illite takes place after deep burial and involves transfer of large amounts of bound water from montmorillonite surfaces to interparticle areas where it is normal water. This transfer has an important bearing on porosity, permeability, abnormal fluid pressure, and initial release of hydrocarbons from mudrocks. In deposits of primary illite, water is compacted out of clay soon after burial, before formation of hydrocarbons comparable with those found in reservoirs. These points are important in petroleum exploration in new areas because development of a shale source rock requires initial deposition of montmorillonitic organic mud, and its subsequent alteration to illite after deep burial. Abnormally high fluid pressures may easily be caused by a volume increase associated with desorption of the last few monomolecular layers of water from montmorillonite during diagenesis to illite.—*from* Author's abstract

Prest, V. K. *See* Mott, R. J. 02171

02307 **Preto, Vittorio Annibale.** Structural relations between the Shuswap terrane and the Cache Creek Group in southern British Columbia [abs.]: Bull. Canadian Petroleum Geology, v. 15, no. 2, p. 208, 1967.

02158 **Pritchard, Donald W.** What is an estuary—Physical viewpoint, *in* Estuaries (edited by George H. Lauff): Am. Assoc. Adv. Sci. Pub. 83, p. 3–5, 1967.

The author defines an estuary as a semi-enclosed coastal body of water which has a free connection with the open sea and within which sea water is measurably diluted with fresh water derived from land drainage. The requirements of this definition are enlarged upon, and a four-fold classification, based on physical characteristics, is established: drowned river valleys, fjord-like estuaries, bar-built estuaries, and estuaries produced by tectonic processes. Another approach to classification of estuaries, by considering the dominant physical processes associated with movement and mixing in the estuary—wind, tide, and inflow of river water—is briefly discussed. The coastal plain estuary is the most common type; its classification is discussed elsewhere in this book (p. 37–44).—GDC

Pulvertaft, T. C. R. *See* Henderson, G. 01955

02080 **Quinlan, James F.; Traverse, Alfred.** Humic acid and humate deposits in Salts Cave and Mammoth Cave, Kentucky—A preliminary report [abs.]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 98–99, 1967.

02090 **Quinlan, James F.** Classification of karst types—A review and synthesis emphasizing the North American literature, 1941–1966 [abs.]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 107–109, 1967.

02091 **Quinlan, James F.; Pohl, E. R.** Vertical shafts actively promote slope retreat and dissection of the solution escarpment and the Chester Cuesta in the Central Kentucky Karst [abs.]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 109, 1967.

11134 **Raasch, G. O.; Bruce, C. J.** Notes on Late Cambrian and Early Ordovician biostratigraphy of southeast British Columbia [abs.], *in* Lower Paleozoic symposium: Bull. Canadian Petroleum Geology, v. 14, no. 4, p. 600, 1966.

Raasch, G. O. *See* Dooge, J. 11136

01966 **Race, W. H.; Rose, A. W.** Geochemical and geological investigations of Admiralty Island, Alaska: Alaska Div. Mines and Minerals Geochem. Rept. 8, 43 p., illus., tables, 1967.

Paleozoic to Tertiary formations are found on Admiralty Island; the northwesterly structural trend is cut by northeast-trending folds and faults in several places. Both the Triassic Hyd and Devonian(?) Hood Bay Formations are associated with volcanism, and possibly have sulfide deposits. The western Hasselborg Lake area is underlain by the Thayer pluton, with a mafic border and a metamorphosed zone several miles wide; two copper prospects at the south and an area of gossans in the northwest are suggested for prospecting. A total of 563 stream-sediment samples was collected from large-size drainages on the island, field tested, and analyzed in the laboratory. Attention is called to 12 areas which warrant further prospecting, the most outstanding being on Hawk Inlet. Regional geochemical and geologic maps accompany the report.—ESL

Radomski, Andrzej. *See* Gradziński, Ryszard. 02352

Raines, Terry W. *See* Russell, William H. 02093

11117 **Rainwater, E. H.** Exploration for natural gas, *in* Natural gas—Inst. Petroleum, Explor. and Production Group, Symposium, London, 1966, Proc.: London, Elsevier Publishing Co., p. 1–28, illus.; reply to discussions, p. 31, 111, 1966.

Natural gas, with or without oil and other liquid hydrocarbons, occurs in various Cambrian to Recent sedimentary rocks; examples are given from Gulf Coastal Plain and Cook Inlet of Alaska. Exploration for trapped accumulations uses all available geological and geophysical methods, experience gained from known petroleum provinces, and imagination. In basins believed to have had a favorable sedimentary history, determination of present structure is the first step, using geophysical methods. Stratigraphy is the foundation of the geologist's evaluation of an area, based, for gas potential, on an understanding of sedimentational environment, tectonic activity, post-depositional movement, and preservation of prolific organic material.—GDC

Ramamurthy, Amruthur. *See* Seetharamiah, Kyatsandra. 01906

02127 **Ramaty, Reuven.** The influence of geomagnetic shielding on C^{14} production and content, *in* Magnetism and the cosmos—NATO Advanced Study Inst. Planetary and Stellar Magnetism, Univ. Newcastle upon Tyne, 1965: New York, American Elsevier Publishing Co., p. 66–78, illus., 1967.

Elsasser and others (1956) found a C-14 production rate variation proportional to $M^{-0.82}$, where M is the geomagnetic dipole moment. In the first part of this paper the production rate is calculated in a more accurate fashion on the basis of Ligenfelter's (1963) calculations in which he showed that the production rate calculation is dependent on latitude. The second part of the paper considers a two-

reservoir model for exchangeable terrestrial carbon and uses the results to evaluate the ratio between the C-14 decay rate at any time to that at present, to calculate the response of the C-14 content to periodic and exponentially varying production rates, and to consider the nonequality between present production and decay of C-14 in relation to geomagnetic variations; finally, paleomagnetic measurements are used to determine corresponding C-14 content variations.—VSN

Rand, J. R. *See* Hurley, P. M. 02043

02048 **Rasmussen, Norman.** Washington State earthquakes 1840 through 1965: Seismol. Soc. America Bull., v. 57, no. 3, p. 463–476, illus., table, 1967.

A tabulation has been made of approximately 850 earthquakes, in Washington State or near its borders, between 1840 through 1965. This list was compiled from previously published scientific reports, newspaper accounts, and unpublished epicenter computations from the University of Washington Seismograph Station. Shocks of intensity V or less are not complete prior to about 1900 because of sparse population making reporting incomplete. There appears to be an increase of larger intensity and magnitude earthquakes since 1936 in Washington State, and especially in the Puget Sound area since 1949.—Author's abstract

Ray, Clayton E. *See* Lipps, Lewis. 02330

02362 **Ray, Clayton E.** Pleistocene mammals from Ladds, Bartow County, Georgia: Georgia Acad. Sci. Bull., v. 25, no. 3, p. 120–150, illus., tables, 1967.

At least 48 species of mammals are known from Ladds [here listed with annotations, or described]; about 1/4 of these are extinct including *Megalonyx sp., Dasypus bellus, Tamias aristus, Peromyscus n.sp., Tremarctos floridanus, Tapirus cf. veroensis, Equus sp., Mylohyus nasutus, Platygonus compressus*. Species of northern affinities include *Sorex cinereus, S. fumeus, Sylvilagus transitionalis, Synaptomys cooperi, Martes pennanti*. Species of southern affinities are *Dasypus bellus, Neofiber alleni, Tremarctos floridanus, Conepatus leuconotus, Panthera onca, Felis (?Herpailurus) sp., Tapirus cf. veroensis*. Paleoecological interpretation of the possibly heterochronic assemblage must await discovery and study of unit faunas.—*from* Author's abstract

Rayner, Frank A. *See* Mount, J. Russell. 01973

11209 **Raytheon-Autometric.** (Terrain Sciences Section). Geoscience potentials of side-looking radar, V. 1–2—U.S. Army Corps Engineers, Contract DA 44 009 AMC-1040(X) for NASA: Alexandria, Va., Raytheon/Autometric, V. 1, 90 p., illus., tables; V. 2, illus. [1966?].

This study was restricted to interpretation, analysis, and evaluation of types of radar imagery available from experimental flight testing of radar equipment. Certain radar bands provide an all weather acquisition capability, supporting the use of side looking radar as a tool for Earth and space geoscience exploration. It is concluded from the various overlays that regional lineations reflect tectonic trends and true structural features, and this is verified by drainage patterns and tonal traces of soil moisture and vegetation in overburden. In mountainous areas accuracy is fair for interpretation of geologic structure and lithology. In general regional physiographic features are clear but microterrain is not generally distinguishable; surficial materials should be interpreted with caution but ice features are readily identifiable.—GDC

11215 **Read, W. F.; Stockwell, H. O.** The Trenton meteorites: Wisconsin Acad. Sci. Arts, and Letters Trans., v. 55, p. 77–85, illus., 1966.

The locations of a number of meteorite specimens found in Trenton Township, Washington County, Wis., from 1858–1964, are given. The external form, structure and composition of some of the specimens are described. Specimen no. 5 is evidently a fragment of a large Ni-Fe crystal and shows evidence of rupture, ablation, and shearing. It has curving kamacite bands, granular texture, numerous plessite fields, and troilite nodules, plates, and grains.—LLP

02157 **Redfield, Alfred C.** The ontogeny of a salt marsh estuary, *in* Estuaries (edited by George H. Lauff): Am. Assoc. Adv. Sci. Pub. 83, p. 108–114, illus., 1967.

The existing peat of tidal marshes preserves a record of its depositional conditions. In reconstructing the development of a typical New England salt marsh and its estuary, principal factors appear to be range of tide, physiology of plants in relation to tide levels, process of sedimentation on open tidal flats and within stands of plants, and relative change in sea level. The morphology of Barnstable Estuary, Mass., is described with illustrations showing distribution of depth of peat and reconstruction of rising mean high-water levels since 1300 B.C. In this time a sandy spit has grown eastward six miles, and the marsh spread out from isolated pockets in the morainic upland on the south, with meandering channels between the advancing tongues. The hydraulic geometry of tidal estuaries near Alexandria, Va., agree with this theory.—GDC

02248 **Redfield, Alfred C.** Postglacial change in sea level in the western North Atlantic Ocean: Science, v. 157, no. 3789, p. 687–692, illus., tables, 1967.

Radiocarbon determinations on peat indicate that at Bermuda, southern Florida, North Carolina, and Louisiana relative sea level has risen at a rate of about 2.5×10^{-3} ft (0.76×10^{-3} m) per year during the past 4,000 years; this is tentatively taken to be the rate of eustatic change in sea level. The sea-level rise has been much faster along the northeast coast of the United States, indicating local subsidence.—*from* Author's abstract

Ree, Taikyue. *See* Hahn, Sang Joon. 02264

01934 **Reed, Eugene C.** Eck Frank Schramm (1883–1967): Am. Assoc. Petroleum Geologists Bull., v. 51, no. 8, p. 957–958, portrait, 1967.

02137 **Rees, Anthony I.** Comment on a paper "Non-opaque and opaque grain fabrics of siltstones in Red Peak Member (Triassic), central Wyoming" by M. Dane Picard and Douglas D. Beckmann [1966]: Jour. Sed. Petrology, v. 37, no. 2, p. 710–711, table, 1967.

The conclusion of Picard and Beckmann (ibid., v. 36, p. 506–521) that nonopaque and opaque heavy mineral grains have different orientations because of the effects of ambient magnetic fields is not supported by the data presented.—RAC

02142 **Reesman, A. L.; Keller, W. D.** Chemical composition of illite: Jour. Sed. Petrology, v. 37, no. 2, p. 592–596, tables, 1967.

Free energies of formation of six separate illites were calculated from aqueous dissolution data on six different illites, and found to approach a uniform value. Thus, illitic parent materials, whether detrital, from solution, authigenic, or diagenetic, apparently have reacted with their aqueous environments to yield uniformly lowest-energy final products consistent with parent material and environments. Because the marine, or alternatively, fresh-water non-marine, environments have been relatively uniform during geologic time, final compositions of illite parent materials will tend to move also toward uniformity in energy, and in consistency with the parent materials present. This offers a thermodynamic basis for proposing 'reference' illite minerals whose compositions are much narrower in range than those of original detrital micas, although the latter fulfill the definition of illite.—*from* Authors' abstract

Reid, John R. *See* Bluemle, John P. 01980

02172 **Reilly, G. A.; Shaw, D. M.** An estimate of the composition of part of the Canadian Shield in northwestern Ontario: Canadian Jour. Earth Sci., v. 4, no. 4, p. 725–739, illus., tables, 1967.

An attempt has been made to estimate the abundance of trace and major constituents in the Precambrian surficial rocks of a large part (43,000 square miles) of the Red Lake Lansdowne House area in northwestern Ontario. One hundred and two composite samples were made to represent eight rock types in seven adjacent map-

areas of equal size. Major element analysis was carried out on eight composite samples representing rock types for the whole area. Analysis by variance techniques have detected significant regional variations of Cr, Mn, Sr, and Ba. Significant variation exists between rock types for all trace elements analyzed except Cu. Author's abstract

Reimann, B. E. F. *See* Delany, A. C. 02341

01920 **Rexroad, Carl B.** Stratigraphy and conodont paleontology of the Brassfield (Silurian) in the Cincinnati Arch area: Indiana Geol. Survey Bull. 36, 64 p., illus., 1967.

Conodonts were collected from 49 sections of the Brassfield Formation in its outcrop belt around the Cincinnati Arch in Indiana, Kentucky, and Ohio. Seven new species and a new subspecies were named. Conodonts show that the Brassfield Limestone belongs to the upper Bereich I of the European conodont zonation. Younger, overlying strata should be placed within the Brassfield; the formation in this area then would include beds of the *celloni* Zone. The Brassfield correlates with the Kankakee Dolomite and Sexton Creek Limestone of the Alexandrian Series in Illinois. Conodonts support evidence that the upper part of the Brassfield is younger in the west and north than in the type section in central Kentucky. The Brassfield overlies Ordovician strata throughout the Cincinnati Arch area, and is overlain by the Noland Formation, Dayton Limestone, or Salamonie Dolomite. —*from* Author's abstract

Reyment, Richard A. *See* Berggren, William A. 01949

Reynolds, Robert C. *See* Anderson, Duwayne M. 02017

11161 **Rice, Donald A.; Daugherty, Kenneth I.; Decker, B. Louis.** Significance of a unified world gravity system, *in* United Nations Regional Cartographic Conf. for Asia and Far East, 4th, Manila, 1964—V. 2, Proc. and Tech. Papers: New York, United Nations, p. 122–125, 1966.

An important contribution of geodesy to mapping is the determination of the exact coordinates of control points on the Earth's surface. A shift from provincial to international thinking and the development of modern technology has revealed discrepancies resulting from the use of various geodetic systems. The space age and its rigid requirements for accurate worldwide mapping and geodetic data established the need for a unified world geodetic system, especially in the application of the gravimetric method. The essential components are: a world calibration standard, an international absolute reference system, and a first order world gravity net. A unified world gravity system will provide more accurate data for use with geodetic satellites and geometric survey techniques to achieve a World Geodetic System.—GDC

02401 **Rich, Mark.** *Donezella* and *Dvinella*, widespread algae in Lower and Middle Pennsylvanian rocks in east central Nevada and west central Utah: Jour. Paleontology, v. 41, no. 4, p. 973–980, illus., table, 1967.

Donezella lunaensis Rácz and *Dvinella comata* Khvorova are widespread in Lower and Middle Pennsylvanian strata in east central Nevada and west central Utah. The former species is restricted to the Morrowan (Early Pennsylvanian) and Atokan (early Middle Pennsylvanian), and the latter extends from the Morrowan into at least the middle part of the Desmoinesian (late Middle Pennsylvanian). Tightly packed masses of *Donezella* Maslov are closely associated with relatively unreworked specimens of *Komia* Korde in cyclical sequences, and the author believes that the *Donezella–Komia* association occupied shallow water in a low energy environment.—Author's abstract

Richardson, J. G. *See* Coats, K. H. 02336

02109 **Richter, D. H.** Geology of the upper Slana–Mentasta Pass area, southcentral Alaska: Alaska Div. Mines and Minerals Geol. Rept. 30, 25 p., illus., tables, geol. map, 1967.

The upper Slana–Mentasta Pass is an area of approximately 275 sq mi in the eastern Alaska Range, and includes a segment of the Denali fault zone, a major strike-slip feature extending from the Bering Sea into northwestern Canada. South of the fault, Permian to Lower Cretaceous sedimentary and volcanic rocks dip moderately to the northeast. North of the fault, metasediments and metavolcanics probably Devonian or older, dip steeply to the southwest. Small stocks intrude almost all of the bedded and metamorphic rocks in the area. A lenticular body of dunite is exposed in the Denali fault zone. Economic occurrences include copper mineralization, placer gold, disseminated and massive chromite, nephrite, and green magnesite. Strong geochemical anomalies occur in drainages north of the fault.—I.I.P.

Richter, Donald H. *See* Rose, Arthur W. 02111

02058 **Riedel, W. R.** Radiolarian evidence consistent with spreading of the Pacific floor: Science, v. 157, no. 3788, p. 540–542, illus., 1967.

In sediments west of the East Pacific Rise between the equator and 20° N., Eocene microfossils are recorded no farther east than 134° W.; Oligocene, no farther east than 125° W.; while Miocene and Pliocene occurrences extend closer to the crest of the rise. This distribution may result from post Eocene spreading of the sea floor here averaging about eight centimeters per year.—Author's abstract

Riesen, T. *See* Oeschger, H. 02212

Rinehart, C. Dean. *See* Huber, N. King, 02059

02016 **Rinker, J. N.; Mock, S. J.** Radar ice thickness profiles, northwest Greenland: U.S. Army Materiel Command Cold Regions Research and Eng. Lab. Spec. Rept. 103, 16 p., illus., 1967.

In June and July of 1964, extensive field trials of radar ice sounding equipment were held on the ice sheet in northwest Greenland. The results, in the form of surface and subsurface profiles over 350 km of trail, are presented.—Authors' summary

02303 **Ripley, Charles F.** Portage Mountain dam—[Pt.] 1, An outline of the project, *in* Canadian Soil Mechanics Conf., 19th, 1966, [Pt.] 2: Canadian Geotech. Jour., v. 4, no. 2, p. 125–141, illus., table, 1967.

The 600 ft high earth fill dam, 500 mi north of Vancouver in British Columbia, will be the center of the Peace River project. The Peace River rises in the Rocky Mtn. Trench and flows eastward through the mountains to join the Mackenzie. The site selected is in the postglacial canyon section cut as a bypass around a section of the ancestral channel blocked by ice and debris. Bedrock is flat lying Cretaceous sandstones, shales, and coal seams, free of faults, with no overburden. Terraces in the ancestral channel, and moraines are suitable for fill material. Site arrangement and design considerations are described. Fill construction was about half finished in June 1966.—ESL

11176 **Robert, Jean-Louis.** Geology, Mount Vallieries de Saint Real area: Mining in Canada, v. 39, no. 12, p. 43–48, 1966.

In this area, Siluro-Devonian sedimentary rocks overlie Ordovician and pre-Ordovician metavolcanic and metasedimentary rocks, and intrusive granitic rocks form wide zones of contact metamorphic alteration. Ordovician and pre-Ordovician rocks are tightly folded in east-west trends. Pre-Silurian rocks contain lenses of copper-rich massive sulfides, and Siluro-Devonian rocks present possibilities of disseminated sulfide deposits.—ARK

02129 **Roberts, P. H.** Frozen fields, core motions and the secular variation, *in* Magnetism and the cosmos: NATO Advanced Study Inst. Planetary and Stellar Magnetism, Univ. Newcastle upon Tyne, 1965: New York, American Elsevier Publishing Co., p. 95–107, illus., tables, 1967.

This is a brief summary of the research reported in detail in the paper by P. H. Roberts and S. Scott, "On analysis of the secular variation—Pt. 1, A hydromagnetic constraint, theory": Jour. Geomagnetism and Geoelectricity, v. 17, no. 2, p. 137–151, illus., 1965.—VSN

Robertson, J. S. *See* Weaver, W. G., Jr. 02124

02261 **Robertson, James A.** Recent geologic investigations in the Elliot Lake Blind River uranium area, Ontario: Canadian Mining Jour., v. 88, no. 4, p. 120–126, 1967.

All commercially significant uranium and thorium deposits of this area are in sheets of oligomictic conglomerate. It is probable that the conglomerate accumulated as placer deposits derived from weathered red phase Algoman granite and that the uranium-bearing minerals were altered and redistributed during diagenesis, during periods of tectonic stress, and during the intrusion of diabase. There is no evidence of cross-cutting uranium mineralization.—ARK

02165 **Robertson, W. A.** Manicouagan, Quebec, paleomagnetic results: Canadian Jour. Earth Sci., v. 4, no. 4, p. 641–649, illus., tables, 1967.

The remanent magnetization of dacitic material from Manicouagan, Quebec, was examined. Laboratory thermal studies support the view that viscous buildup in situ was small and secondary components insignificant. A pole position of 89° E., 57° N. is calculated from the mean direction of six sites. Comparison with other North American paleomagnetic poles points to a possible Triassic age for the formation of the material.—Author's abstract

01927 **Robinson, E.** The *Globoquadrina altispira/Globorotalia truncatulinoides* Zone in Jamaica [discussion of "Zonation based on planktonic foraminifera . . . " by H. M. Bolli and P. J. Bermúdez, 1965]: Asoc. Venezolana Geología, Minería y Petróleo Bol. Inf., v. 10, no. 3, p. 97–98, 1967.

Bolli and Bermúdez (ibid., v. 8, no. 5, p. 121–149, 1965) have proposed seven zones based on planktonic Foraminifera for the middle Miocene to Pliocene of Jamaica, Venezuela, and Java. Robinson here questions the validity of the lower of the two Pliocene zones. This zone is based solely on evidence from two localities in Jamaica; the zone type is the type locality of the Manchioneal Formation, which overlies the Bowden Formation unconformably here and at several other localities in eastern Jamaica. *Globorotalia truncatulinoides* is an index fossil for the Manchioneal, occurring commonly at or near its base. Robinson has never found *Globoquadrina altispira altispira* at this horizon and both fossils are absent from an interval at the top of the Bowden. Any presence of *G. altispira* in the Manchioneal must be due to reworking.—VMJ

Robinson, Rhoda. *See* Pakiser, L. C. 11151

Robison, Richard A. *See* Pantoja-Alor, Jerjes. 02194

02163 **Roed, M. A.; Mountjoy, E. W.; Rutter, N. W.** The Athabasca Valley Erratics Train, Alberta, and Pleistocene ice movements across the Continental Divide: Canadian Jour. Earth Sci., v. 4, no. 4, p. 625–632, illus., tables, 1967.

The Erratics Train, occurring in, and west of, the Athabasca Valley west of Edson, Alberta, contains a variety of metamorphic rocks. It is probably a late stage deposit of the same glacier that carried and deposited the Erratics Train, Foothills of Alberta. The erratics were incorporated into a glacier that originated in the northern part of the Monashee Mountains and Premier Range of British Columbia; ice movement also is recorded by numerous U shaped valleys, extending across the Continental Divide. Thus, during a brief period in late(?) Wisconsin time, Cordilleran ice in the Rocky Mountains of the Jasper National Park area was partly derived from west of the Continental Divide and the Rocky Mountain Trench. These data agree with the inferred ice movements shown on the 1958 Glacial Map of Canada.—ESL

Roether, W. *See* Zimmerman, U. 01925

02159 **Roliff, W. A.** A stratigraphic analysis of the subsurface data relating to the Chazy Group in the St. Lawrence Lowland of eastern Canada: Canadian Jour. Earth Sci., v. 4, no. 4, p. 579–595, illus., table, 1967.

Surface exposures and seven logs have indicated the Ordovician Chazy to be mainly calcareous shales, shaly limestones, limestones, and some sandstones. Data from 30 additional wells indicate sediments vary laterally from limestone with some shale and sandstone in the belt bordering the Shield, to predominantly dolomite with some limestone, shale, and sandstone basinward, southeast of the St. Lawrence; this suggests a platform or foreland type of deposit—a product of a transgressing sea. Absence of dolomite in outcrops and similarity of sandstones to those of older Beekmantown and Potsdam Groups misled geologists in interpretation of data in a number of wells, particularly in the Three Rivers area. Recognition of these mistakes explains the apparently anomalous thickness of the Chazy, as reported in published logs. New evidence on the Chazy–Black River relationship is presented.—ESL

01908 **Rona, Peter A.; Clay, C. S.** Stratigraphy and structure along a continuous seismic reflection profile from Cape Hatteras, North Carolina, to the Bermuda Rise: Jour. Geophys. Research, v. 72, no. 8, p. 2107–2130, illus., tables, 1967.

A continuous reflection profile from the continental slope off Cape Hatteras to the Bermuda Rise shows that each physiographic province is underlain by distinctive patterns of reflection interfaces which may correspond to sequences of well-stratified sediment; these are described. Reflection interfaces of the lower continental rise and adjacent Hatteras abyssal plain are interpreted in terms of gravitational gliding; strata from the continental rise may have glided for as much as 100 km over the projected initial reflection zone of the Hatteras abyssal plain. Gravity gliding would explain the observed configuration of reflection interfaces and is theoretically feasible on the continental rise.—DBV

02372 **Rondot, Jehan.** Geology of L'Anse Saint Jean area, Chicoutimi and Charlevoix counties [also French edition]: Quebec Dept. Nat. Resources Prelim. Rept. 556, 13 p., table, geol. map, 1966 [1967].

Steep hills in the central and western part of this area are underlain by the Laurentian charnockitic massif; in a narrow strip of rolling hills along the eastern side are gneiss, migmatite and granite. In the northern part of the massif one homogeneous rock has an abrupt contact and greater proportion of dark minerals; a dioritic plug was noted southeast of Sagard. To the east, gneisses are cut by muscovite pegmatite containing tourmaline. There are dikes and small masses of basic and ultrabasic rocks, and along major faults pegmatites, aplites and alaskitic injections. Recent deposits, rare except in large valleys, include layered clay 500 feet above sea level, covered by sand. Structure is complex near the center of the massif, but the rocks become banded parallel to, and dip eastward under the granite contact. There are northern zones of intense granulation.—GDC

11180 **Rooney, Lawrence F.** Cement raw materials in Indiana, *in* Symposium on geology of cement raw materials—Forum on geology of industrial minerals, 2d, 1966, Proc.: Bloomington, Ind., Indiana Geol. Survey and Indiana Univ., p. 13–21, illus., tables [1966?].

Suitable shale and clay deposits can be found in many formations of Pennsylvanian, Mississippian, and Ordovician age; glacial drift and residual soil can also serve as a source of clay and silt. Gypsum and anhydrite are mined near Shoals, Martin County, and undeveloped deposits are known in Greene, Owen, and LaPorte Counties. Large reserves of high quality limestone are readily available in several formations of Mississippian age, notably the Paoli, Ste. Genevieve, and Salem Limestones; recent coring has revealed thick units of low magnesium Devonian limestone at shallow depth near Indianapolis. Recently a low magnesium limestone unit in the Ordovician Trenton and Black River Limestones was discovered at a 296 ft depth near Patriot, Switzerland County.—*from* Author's abstract

02231 **Rooney, Thomas P.; Kerr, Paul F.** Mineralogic nature and origin of phosphorite, Beaufort County, North Carolina: Geol. Soc. America Bull., v. 78, no. 6, p. 731–748, illus., tables, 1967.

A Miocene phosphorite deposit in Beaufort County, N. C., has estimated reserves of 10 billion tons and where examined, is 60 feet thick and contains about 18 percent P_2O_5. The sediment consists of phosphate pellets, quartz grains, and clay, with thin beds of coquina and dolomite. The pellets contain quartz grains, glauconite, carbonaceous matter, and organic remains; the phosphorite mineral is francolite. The clay fraction includes montmorillonite, illite, and clinoptilolite and probably originated through alteration of volcanic detritus. The phosphorite presumably originated in a shallow marine basin with a reducing environment. —*from* Authors' abstract

Rose, A. W. *See* Race, W. H. 01966

02111 **Rose, Arthur W.; Richter, Donald H.** Geology and stream sediment geochemistry of Anton Larsen Bay and vicinity, Kodiak Island, Alaska: Alaska Div. Mines and Minerals Geol. Rept. 31, 10 p., tables, 1967.

The Anton Larsen Bay area is underlain principally by Mesozoic interbedded graywacke and slate; the rocks appear to be isoclinally folded and generally dip northwest. Small stocks and a granodiorite dike intrude the sedimentary rocks. Geochemical stream sediment sampling has not revealed any significant anomalous metal concentrations, but suggests that occurrences of scheelite in graywacke on Sharatin Mountain are small and local. Gold quartz veins, which are fairly common in granodiorite on Anton Larsen Bay, may represent a potential gold source. The veins generally assay 3–10 dollars per ton in gold, and it is possible that higher grade ore and more extensively mineralized zones will be found. —LLP

02398 **Ross, Charles A.** *Eoparatusulina* from the Neal Ranch Formation (Lower Permian), west Texas: Jour. Paleontology, v. 41, no. 4, p. 943–946, illus., 1967.

Based on morphological differences, species of *Eoparatusulina* Coogan are grouped into two new subgenera, *Eoparatusulina and Mecloudia*. *Alaskanella* Skinner and Wilde is here considered a junior subjective synonym of *Eoparatusulina* because it appears to be characterized by the same morphological features. *Eoparatusulina* (*E.*) *allisonensis* n.sp. from the upper part of the Neal Ranch Formation, near Gap Tank, Glass Mountains, Texas, is a primitive species that has well developed chomata and strongly folded septa. This species extends the range of *Eoparatusulina* downward into lower Wolfcampian strata. —*from* Author's abstract

11126 **Ross, Herbert H.** Understanding evolution: Englewood Cliffs, N. J., Prentice-Hall (Spectrum Book), 175 p., illus., 1966.

An effort has been made to express the material of this book without using the more technical aspects of scientific terminology. However, where some technical terms in a variety of scientific fields are introduced, each is oriented with its relation to subject matter. The ten chapter headings are: history of evolutionary thought; evolution of the universe; life—its nature and origin; progress of life; passage through time; variation and natural selection; increase in number of species; geotectonic factor; evolution of ecological communities; and progression of change. —GDC

02278 **Rowell, Albert J.** A numerical taxonomic study of the Chonetacean brachiopods, *in* Essays in paleontology and stratigraphy—R. C. Moore Commemorative Volume: Kansas Univ. Dept. Geology Spec. Pub. 2, p. 113–140, illus., tables, 1967.

Two recent classifications of Chonetacea, produced by nonnumerical phenetic methods differ markedly from each other. Phenograms produced by a variety of clustering methods on matrices of resemblance estimated by average distance and correlation coefficients show congruence in composition of early formed clusters, but differ in suggested interrelations of these. The unweighted pair group method of clustering produces the least distortion of the original matrices, and the most convenient classification can be derived from the correlation coefficient phenogram produced by it. Whether this classification is superior to that based on average

distance will be decided when relative predictabilities are tested. The "best" numerical classification resembles one of the conventional ones much more closely than the other and, in its suggested groupings of similar genera, seems superior to both. —*from* Author's summary

11144 **Royal Meteorological Society Council; Sawyer, J. S.** (editor). World climate from 8000 to 0 B.C. —Proceedings of the international symposium, London, 1966: London, Royal Meteorol. Soc., 229 p., illus. [1966?].

The aims of this conference on world climate were to arrive at the global pattern of climatic change, to deal with datable events and reveal some measure of the meteorological variables, without much concern with theories. Limited to the period of 8000 years B.C., various papers include four, separately cited, which deal with evidence from Alaska glaciers, sea level changes of the Gulf Coast compared with other regions, palynological evidence from Chile and the Pacific northwest of America, and the precision of the paleoclimatic record in stratigraphy of lake sediments (especially Minnesota sites). Advances in techniques and some problems reviewed include radiocarbon dating; pollen analysis, macroscopic organic remains, as well as lake and bog stratigraphy, ocean deposits and eustatic changes in sea level. GDC

01981 **Royse, Chester F., Jr.** Tongue River–Sentinel Butte contact: North Dakota Geol. Survey Rept. Inv. 45, 53 p., illus., table, 1967.

A change in the lithostratigraphic terminology of the Paleocene Series in western North Dakota is recommended. The Tongue River–Sentinel Butte contact is defined in this report as a distinctive horizon between two lithogenetic units characterized by: a lignitic horizon at the top of the Tongue River sequence, a basal sandy unit in the Sentinel Butte sequence, and a marked color change between the two sequences. The contact has been mapped throughout much of western North Dakota, and outcrops can be seen along the eastern margin of the Williston basin and in Morton County. Therefore, it is recommended that the Sentinel Butte, which has been regarded as a subordinate unit of the Tongue River, be raised to formational rank. The Fort Union Group would then consist of Sentinel Butte, Tongue River, Ludlow, and Cannonball Formations. —LLP

02046 **Rubey, William W.** Introduction, *in* Chemical composition of sedimentary rocks in Colorado, Kansas, Montana, Nebraska, North Dakota, South Dakota, and Wyoming: U.S. Geol. Survey Prof. Paper 561, p. 1–7, illus., 1967.

This introduction to a report on chemical analyses of sedimentary rocks includes discussions of the project background, analyses selection and arrangement, and classification of sedimentary rocks. The analyses are not a true representation of all the sedimentary rocks in a region because many were selected for economic value or unusual composition. A large proportion of the rocks analyzed belong to the common rock rather than the mixed rock category. —LLP

Rubin, Meyer. *See* Ives, Patricia C. 02226

02191 **Rusnak, Gene A.** Rates of sediment accumulation in modern estuaries, *in* Estuaries (edited by George H. Lauff): Am. Assoc. Adv. Sci. Pub. 83, p. 180–184, illus., 1967.

Estuarine sediments accumulate by positive filling from rivers, inverse filling from the sea by flood tides, and neutral filling by lateral distribution of materials eroded from the basin margin. Pleistocene rate of supply was controlled largely by sea level oscillations and the amount accumulated, by geographic position and topography. Interglacial conditions resulted in vast accumulation in marginal marine bays, lagoons, and the continental shelf. In subsequent glacial periods, by erosive action of receding seas and stream degradation, these sediments were released to continental slopes and deep sea. Erosive scars, some above present sea level and filled with Recent sediments, testify to many glacial eustatic changes. In the light of established curves, and from radiocarbon dating of these deposits, tentative rates of accumulation are derived. GDC

01907 **Russell, Ernest E.** Geologic map of the Michie quadrangle, Tennessee (including the Tennessee portion of the Kendrick quadrangle, Mississippi Tennessee): Tennessee Div. Geology Geol. Map GM 13 SW, scale 1:24,000, separate text, 1967.

The accompanying text, "Mineral resources summary of the Michie quadrangle, Tennessee," describes the sand and gravel deposits in the area. Large, minable bodies of sand and gravel are present in the eastern half where remnants of fluvial material deposited by the Tennessee River and its tributaries during an earlier erosional cycle are preserved at elevations above 560 feet. Small deposits are found at lower elevations on slopes along creeks. Sand and gravel in flood plains of present streams contain more silt and are not as thick as older deposits. Of the 39 pits in the quadrangle, 24 had been active recently.—MCM

01918 **Russell, Ernest E.** Geologic map of the Manleyville quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 20 NW, scale 1:24,000, separate text, 1967.

The accompanying text, "Mineral resources summary of the Manleyville quadrangle, Tennessee," by R. E. Hershey (1967) is cited separately in Abstracts of North American Geology, November 1967.—MCM

02242 **Russell, Richard J.** Origins of estuaries, *in* Estuaries (edited by George H. Lauff): Am. Assoc. Adv. Sci. Pub. 83, p. 93–99, illus., 1967.

Estuaries were uncommon features during most of the Earth's history, while continents were low and relatively flat. This "normal" condition has been interrupted by crustal unrest, orogeny, and continental glaciation. A rapid drop in sea level during waxing of the last major glaciation is indicated by the relatively narrow trench the lower Mississippi River cut in Recent alluvium. As sea level rose, estuaries became numerous and complex, as varied as their natural setting; most have changed appreciably in the last 3,000 years, those in hard rocks the least. Advancing deltas are the most formidable modification, leading to eventual extinction of estuaries, as in the old Mississippi, the Amazon, and historical Maeander (described by Herodotus).—GDC

02093 **Russell, William H.; Raines, Terry W.** Recent additions to the knowledge of cave distribution in Mexico [abs.]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 110–111, 1967.

02094 **Rutherford, John M.** Initial explorations in the contact caves of the Great Savanna [abs.]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 111–112, 1967.

Rutter, N. W. *See* Roed, M. A. 02163

02339 **Sandberg, Philip A.; Hay, William W.** Study of microfossils by means of the scanning electron microscope: Jour. Paleontology, v. 41, no. 4, p. 999–1001, illus., 1967.

The scanning electron microscope (SEM), now commercially available, has a depth of field 500 times that of a light microscope, a range of magnifications from 15x to 20,000x, resolution 10 times that of a light microscope and can take suitably prepared whole specimens rather than thin replicas. The original specimen, not a replica, is used, although the specimen must be coated. The simplicity of use of the SEM coupled with the large number of observations and photographs possible per day's work will surely make this a valuable laboratory tool, the use of which will probably revolutionize ideas on microfossil phylogenies, biostratigraphy, and functional morphology.—JFM

02349 **Sanderson, G. A.** A bibliography of the family Fusulinidae, addendum 4: Jour. Paleontology, v. 41, no. 4, p. 1006–1012, 1967.

Addendum 4 contains 200 references concerning the family Fusulinidae, which brings the cumulative total in this series to 1,735. Acquisition of a large number of references previously omitted from the bibliography has prompted this special listing in addition to the regular addendum in the November issue of the Journal. Author's introduction

02240 **Sass, Daniel B.; Monroe, Eugene A.** Shell-growth in Recent terebratuloid Brachiopoda: Palaeontology, v. 10, pt. 2, p. 298–306, illus., 1967.

The structure of the brachial valve of four Recent species of terebratuloids was investigated by techniques involving both electron microscopy and light microscopy. The combined approach reaffirmed the conclusions of some previous workers [in studies on Recent and fossil brachiopods] and provided new data on shell growth. The interpretation of patterns observed when sections are cut through the shells is complicated not only by the spatial orientation of the section itself, but by the habit of the truncated crystals as well. Changes in the nature of crystal growth, orientation, and distribution are shown to be related to retraction of the mantle evidenced at major growth lines.—Authors' abstract

02162 **Saull, V. A.** Examples of natural photography from Renfrew County, Ontario: Canadian Jour. Earth Sci., v. 4, no. 4, p. 619–623, illus., 1967.

Blue-green algae grow on water-covered carbonate bedrock in the Bonnechere River 2 miles (3.2 km) northwest of Eganville, Renfrew County, Ontario. The algal growth is sunlight-controlled, and the growth patterns are photographic records of present-day solar radiation at the field site. Equivalent patterns may be identifiable in ancient rocks, and if so, could be used to determine paleodirections, and possibly paleolatitudes as well.—Author's abstract

Sawyer, J. S. *See* Royal Meteorological Society Council. 11144

11158 **Scher, Marvin B.** New developments in orthophotography, *in* United Nations Regional Cartographic Conf. for Asia and Far East, 4th, Manila, 1964—V. 2, Proc. and Tech. Papers: New York, United Nations, p. 383–386, illus., 1966.

The considerable amount of research and development in orthophotography that has occurred in the past few years accurately reflects the promise of this new product. Since the 1960 meeting of the International Society for Photogrammetry, significant changes have been made in the Orthophotoscope as designed in the research laboratories of the United States Geological Survey. Much attention has been given to improving the techniques for preparing orthophotographs, orthophotomosaics, and orthophotomaps. Studies are continuing to determine effective mapping applications of orthophotographs. The reaction of the map-using public to orthophotomaps is being closely observed.—Author's abstract

Schmalz, B. L. *See* Hawkins, D. B. 01952

Schmidt, Ruth A. M. *See* Neale, John W. 01951

02028 **Schmincke, Hans-Ulrich.** Graded lahars in the type sections of the Ellensburg Formation, south-central Washington: Jour. Sed. Petrology, v. 37, no. 2, p. 438–448, illus., tables, 1967.

The Miocene-Pliocene Ellensburg Formation west of Yakima, Wash., contains up to 15 lahars—massive, sheet-like volcaniclastic deposits averaging 6–15 feet thick. They probably originated on flanks of explosive volcanoes in an ancient Cascade chain some 40 miles to the west, and moved partly as inertia type flows which explains the inverse grading from a thin fine-grained basal layer to a massive coarse, poorly sorted central portion and, finally, to a bedded or cross-bedded top zone. Grain size and mineral composition are discussed.—VSN

Schrayer, G. J. *See* Zarrella, W. M. 02039

02200 **Schubel, J. R.** On suspended sediment sampling by filtration: Southeastern Geology, v. 8, no. 2, p. 85–87, 1967.

Filtration is often used to study the suspended sediment of natural waters. The majority of studies have used cellulose membrane filters. The recently developed metal membrane filters have a number of advantages over cellulose, and the author recommends them for determinations of concentrations of suspended sediment. For a complete study, two samples are needed, one large sample, preferably collected

on a metal filter, for mass determination, and a smaller, collected on a cellulose filter, for optical examination and size analysis.—*from* Author's abstract

01975 **Schwade, Irving T.** Geologic quantification—Description→numbers→success ratio: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 7, p. 1225–1239, tables, 1967.

In order to evaluate the risk–return ratio of an oil exploration program, the geologic data should be evaluated numerically. A check list organizes the data into the three major trapping factors of environment of deposition, stratigraphy, and structure, and further subdivides them into 198 geologic elements. The expected condition of development of each element that is essential to the prospect is expressed as a percentage of the optimum development of that element.—WCC

02135 **Schwartz, Maurice L.** Littoral zone tidal-cycle sedimentation: Jour. Sed. Petrology, v. 37, no. 2, p. 677–683, illus., tables, 1967.

A depth-integrated fluorescent tracer procedure was developed to study the movement of individual sand grains along the beach profile. The pattern of littoral zone tidal-cycle sedimentation derived from collected data is described.—EJC

02291 **Scott, D. L.** Potential Upper Cretaceous sedimentologic and stratigraphic research projects, Gulf Islands, Strait of Georgia, British Columbia: Bull. Canadian Petroleum Geology, v. 15, no. 1, p. 114–120, illus., 1967.

Upper Cretaceous strata exposed along the shores of the Gulf Islands and adjacent east coast of Vancouver Island possess interesting stratigraphic relationships, and could provide material for many detailed research projects. Suggested topics include detailed studies of the graded beds and of each of the individual Upper Cretaceous formations in the Nanaimo basin, and a study of the genesis of the total Upper Cretaceous succession in the Nanaimo Basin and reconstruction of the Late Cretaceous tectonic history.—LLP

02308 **Scott, D. L.** Stratigraphy of the lower Rocky Mountain Supergroup in the southern Canadian Rocky Mountains [abs.]: Bull. Canadian Petroleum Geology, v. 15, no. 2, p. 208, 1967.

Scott, Harold W. *See* Hansman, Robert H. 02327

01906 **Seetharamiah, Kyatsandra; Ramamurthy, Amruthur.** Spectral analysis of sand waves—Discussion [of paper 4910, by C. F. Nordin, Jr., and J. H. Algert, 1966]: Am. Soc. Civil Engineers Proc., v. 93, paper 5214, Jour. Hydraulics Div., no. HY 3, p. 228–229, 1967.

An alternative to the second-order Markov model is the more direct method of breaking up a single member of a process into a number of elements, forming an ensemble of the subgroup, and examining the stability of the salient characteristics of the members. Another advantage of the single-point Eulerian correlation is that the individual transducer response characteristics do not have to be matched (original paper, ibid., v. 92, no. HY 5, p. 95–114, 1966).—LLP

02150 **Serruya, Collette; Picard, Leo; Chilingarian, George V.** Possible role of electrical currents and potentials during diagenesis ("electrodiagenesis"): Jour. Sed. Petrology, v. 37, no. 2, p. 695–698, illus., tables, 1967.

Experimental work by the writers suggests that electrical currents and potentials affect some diagenetic processes; this may be termed "electrodiagenesis." It was discovered that currents (produced chiefly by ionic exchange processes) flowing through sediments may stimulate cementation and the formation of authigenic minerals such as gibbsite, limonite, calcite, hydrohematite, hydrogoethite (lepidocrocite), hisingerite, allophane, allophanoid, gypsum, hematite, magnetite, nontronite, trona, and natron ($Na_2CO_3 \cdot 10H_2O$). Currents may also cause selective ion drive and explain zonation of some trace elements, various minerals, etc. Authors' abstract

Shamburger, Victor M., Jr. *See* Mount, J. Russell, 01973

02405 **Shannon, R. D.** Synthesis of some new perovskites containing indium and thallium: Inorganic Chemistry, v. 6, no. 8, p. 1474–1478, illus., tables, 1967.

High pressure synthesis of orthorhombic perovskite compounds of the type $A^{[7]}B^{[7]}O_3$ where one of the cations is In or Tl and the other is Fe, Cr, Y, Eu, Gd, Dy, Rh, or Mn is reported. The use of high pressure is shown to enlarge the perovskite stability field. Distortions of the ideal perovskite structure resulting from deviations in size of the A^{+3} or B^{+3} ions from ideal values are discussed. A plot of r_B^{+3} vs. unit cell volumes is used to derive effective (coordination number 6) ionic radii of Sc^{+3}, Ti^{+3}, V^{+3}, Cr^{+3}, Mn^{+3}, Co^{+3}, Ni^{+3}, and Rh^{+3}.—Author's abstract

02253 **Shapiro, Stephen M.; O'Shea, Donald C.; Cummins, Herman Z.** Raman scattering study of the alpha–beta phase transition in quartz: Phys. Rev. Letters, v. 19, no. 7, p. 361–364, illus., 1967.

The Raman spectrum of crystalline quartz has been studied at temperatures between 196 and 615°C. A weak mode of symmetry A_1 with room temperature Raman shift of 147 cm^{-1} is found to grow in intensity and move towards zero Raman shift as the alpha–beta transition is approached. This mode, rather than the 207-cm^{-1} mode, appears to play the fundamental role in the phase transition.—*from* Authors' abstract

02230 **Sharp, Robert V.** San Jacinto fault zone in the Peninsular Ranges of Southern California: Geol. Soc. America Bull., v. 78, no. 6, p. 705–729, illus., table, geol. map, 1967.

The straightness, continuity, and high seismicity of the San Jacinto fault zone, as well as its present right-lateral strain rate, suggest that this fault may currently be the most active member of the San Andreas fault system in southern California. Distinctive Pleistocene gravels are offset at least 3.2 miles, and stream courses have been displaced 0.45 mile in a right-lateral sense. Extrapolation of critical offset contacts of distinctive sequences of generally steep-walled bodies of intrusive rocks of the mid-Cretaceous southern California batholith, and prebatholitic metasedimentary rocks, indicates that the cumulative movement along the San Jacinto fault zone has been of oblique type. The right-lateral component is about 15 miles; the vertical component moved the southwestern side up a probable one to two miles.—HCE

Shaw, Chester W. *See* Baxter, James W. 02125

01970 **Shaw, D. M.** U, Th, and K in the Canadian Precambrian shield and possible mantle compositions: Geochim. et Cosmochim. Acta, v. 31, no. 7, p. 1111–1113, table, 1967.

Using a value of 4.55×10^{-6} cal per g per yr for the present-day average Precambrian shield heat production (inferred from estimated concentrations of U, Th and K in surficial exposures), and using an average heat flow value of 1.4×10^{-6}, three meteoritic earth models are considered, both assuming and rejecting a difference in composition between suboceanic and subcontinental mantle. Whether to reject or accept lateral independence cannot be decided, but if the average achondrite used here can be considered a possible Earth source in spite of its high heat production, then its content of radioactive elements allows some flexibility for considering possible fractionation mechanisms in the young Earth.—DBV

Shaw, D. M. *See* Reilly, G. A. 02172

Shaw, David M. *See* Donn, William, 02360

01943 **Shearer, J. I.** Bottom sediments of Port au Port Bay, Newfoundland—Progress report: Maritime Sediments, v. 3, no. 1, p. 5, 1967.

In addition to the regular statistical parameters, a detailed analysis of the probability plots of the size distribution of each sample is being made using Tanner's method of finite differences. So far analyses indicate that much reworking of sediments in the Bay has taken place and no vestiges of the original glacial till exist. Recent sediments are composed mainly of an acid-type mineral suite mixed with basic minerals near shore.—ESL

Shinn, E. A. *See* Stockman, K. W. 02144

11147 **Shoemaker, Robert Earl.** Fossil leaves of the Hell Creek and Tullock Formations of eastern Montana: Palaeontographica, v. 119, ser. B, nos. 1–3, p. 54–75, illus., table, 1966.

An examination of seven localities in the Fort Peck region has revealed that during the late Upper Cretaceous (Hell Creek), elements of the Paleocene (Tullock) flora were already present. The overall flora, during Upper Cretaceous time, occurred in a number of ecological niches, each with a number of different species, but also with species in common. No new species were found, but the range of *Metasequoia occidentalis* (Newberry) Chaney is extended downward into the Upper Cretaceous (Hell Creek), and the names *Ficus ceratops* Knowlton, *Viburnum marginatum* Lesquereux, and *V. montanum* Knowlton are retained.—*from* Author's abstract

Short, James M. *See* Goldstein, Joseph I. 02388

02177 **Siegel, Frederic R.** Properties and uses of the carbonates, Chap. 9 *in* Developments in sedimentology—[V.] 9B, Carbonate rocks—Physical and chemical aspects: Amsterdam and New York, Elsevier Publishing Co., p. 343–393, illus., tables, 1967.

Carbonate rocks are raw materials indispensable to industrial development. In recent years, limestone, dolomite, and marble constituted more than 70 percent of all rocks quarried in the United States. Statistics on production and dollar value for 1961, 1962, and 1963 are presented, by uses. The uses to which carbonate rocks and minerals can be put is a function of their physical and/or chemical properties. This chapter contains listings of selected chemical analyses and important physical properties of carbonate rocks. More than one hundred uses for carbonate rocks and minerals are given together with the users' general chemical and physical requirements. Because of space limitations, only three of the many areas of active research on carbonate properties are discussed: solid solution and subsolidus relations, thermoluminescence, and infrared absorption.—Author's abstract

02408 **Simons, P. Y.; Dachille, F.** The structure of TiO_2 II, a high pressure phase of TiO_2: Acta Cryst., v. 23, pt. 2, p. 334–336, tables, 1967.

TiO_2 II was first prepared by Dachille and Roy (1962) but the powder pattern was not indexed nor structure type determined. The high pressure phase of TiO_2, synthesized in this study from anatase and from brookite, is shown to be isostructural with α PbO_2 from powder X-ray techniques. The structural analysis revealed two sets of Ti–O distances in each octahedron, two at 2.05 ± 0.04 A and four at 1.91 ± 0.07 A. Also observed is a Ti–Ti distance of 3.07 ± 0.04 A.—GDC

02376 **Simpson, J. F.** The frequency distribution of volcanic crater diameters: Bull. Volcanol., v. 30, p. 334–335, table, 1967.

Terrestrial volcanic craters were divided into three categories—explosion craters, calderas, and both combined. The craters were then arranged according to diameter and the lists broken into groups based on diameter increments of 1 km. Tabulation of the results shows that explosion craters are five times more numerous, and predominantly less than 1 km in diameter. Caldera diameters are more variable, with a modal value between 2 and 3 km, median value of about 13 km, and maximum of 23–24 km, which is twice the maximum for explosion craters. When the two populations are combined, the average diameter is less than 1 km.—DBV

02044 **Sims, P. K.; Gable, D. J.** Petrology and structure of Precambrian rocks, Central City quadrangle, Colorado: U.S. Geol. Survey Prof. Paper 554-E, p. E1–E56, illus., tables, geol. map, 1967.

This quadrangle is underlain by Precambrian rocks which are intruded by abundant porphyritic igneous rocks of Tertiary age. The Precambrian rocks are dominantly metamorphic gneisses of sillimanite grade and constitute a normal stratigraphic succession consisting of microcline-quartz-plagioclase-biotite gneiss and migmatitic biotite gneisses, with layers and lenses of amphibolite, cordierite-amphibole gneiss, calc-silicate gneiss, and related rocks. The Precambrian igneous rocks, some of which have been metamorphosed, consist of granodiorite and associated gabbro, quartz diorite and hornblendite, and biotite-muscovite quartz monzonite; each with associated pegmatites intrudes the layered rocks. The rocks were deformed by two Precambrian episodes of folding and metamorphism and by a younger episode of faulting.—PKS

Sirkin, Leslie A. *See* Connally, G. Gordon. 01924

11193 **Skinner, J. W.; Wilde, G. L.** Novyy vid permskikh fuzulinid iz yuzhnoy chasti Britanskoy Kolumbii, Kanada: Akad. Nauk SSSR Voprosy Mikropaleontologii, no. 10, p. 105–108, illus., 1966.

A new species, *Parafusulina thomassoni*, collected from the Cache Creek series northeast of Kamloops, British Columbia, is described. This find is indicative of an early Guadelupe age, although fusulinids from other localities in the vicinity have been referred to the Morrow and Wolfcamp. This suggests that the geology of the region is very complex and that the Cache Creek series comprises beds of Early Pennsylvanian to Middle Permian age.—DBV

02384 **Skinner, John W.; Wilde, Garner L.** *Eowaeringella*, new generic designation for fusulinids of the group of *Wedekindellina ultimata* Newell and Keroher: Jour. Paleontology, v. 41, no. 4, p. 1004–1005, 1967.

Eowaeringella n.gen. is proposed; type species is *Wedekindellina ultimata*, Middle Pennsylvanian (Missourian) of midcontinental U.S. Some species of *Eowaeringella* resemble *Wedekindellina* superficially. The principal differences lie in the development of axial filling and in the fluting of the septa. In *Wedekindellina* the axial filling fills the axial zone almost solidly, particularly in inner volutions, whereas in *Eowaeringella* limits of the individual whorls are readily discernible, even along the axis. In *Wedekindellina* septa are essentially plane from pole to pole, but in *Eowaeringella* they develop a moderate amount of fluting in the polar regions. RCD

11174 **Small, James B.** Progress on precise levelling and study of vertical crustal movement in the United States, *in* United Nations Regional Cartographic Conf. for Asia and the Far East, 4th, Manila, 1964—V. 2, Proc. and Tech. Papers: New York, United Nations, p. 126–129, 1966.

As of July 1, 1964, the Coast and Geodetic Survey had established 192,224 miles of 1st-order and 291,147 miles of 2d-order leveling in a network of lines covering the United States. The instruments and techniques used and the processing and publication of results are summarized briefly. Releveling undertaken to keep the 1st-order network up to date has revealed considerable vertical movement of the Earth's surface in some areas resulting from both natural and man-induced causes (removal of ground water, etc.). The San Jose, San Joaquin, Sacramento-Stockton-Fairfield, California, areas; the Galveston-Houston, Texas, area; the New Orleans, Louisiana, area; and the Seward-Anchorage-Matanuska, Alaska, area are cited as examples.—VSN

Smith, Alan R. *See* Wollenberg, Harold A. 11206

02095 **Smith, Gordon L.** Exploration of the Cave Hollow System [abs.]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 111–112, 1967.

01957 **Smith, J. Hiram.** Geologic map of the Wofford quadrangle, Whitley County, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-617, scale 1:24,000, section, text, 1967.

Coal for domestic and industrial use has been mined in the Wofford quadrangle; in 1963 only strip mines in the Jellico and Blue Gem beds were active. The Jellico averages about 24 inches in thickness; the Blue Gem about 20 inches but is seemingly more persistent. Petroleum and natural gas wells are localized along or near the Cumberland River. Petroleum is produced chiefly from the Rockcastle Conglomerate Member of the Lee Formation which in the productive area ranges from 700–900 feet in depth; most wells produce 1–3 bbl per day. Natural gas is produced from the Newman Limestone at a depth ranging from 1,200–1,365 feet. Shale from the lower part of the Breathitt Formation has been tested and found suitable for use in lightweight aggregate. Landslides are commonly associated with clay beds in the Breathitt Formation and are most prevalent in the unit underlying the River Gem coal bed.—MCM

Smith, J. V. *See* Appleman, D. E. 11130

Sneath, Peter H. A. *See* Merriam, Daniel F. 02272

02067 **Souders, V. L.** Availability of water in eastern Saunders County, Nebraska: U.S. Geol. Survey Hydrol. Inv. Atlas HA-266, scale 1:125,000, text, 1967.

The sheet includes maps showing physical setting and climate, and hydrology and ground-water quality in eastern Saunders County; tables of explanation and appraisal of soils, and range of temperature and precipitation; graphs of discharge and chemical quality of water; sections; and a chart of the rock units and their water-bearing characteristics. Quaternary sand and gravel deposits are the most important ground-water reservoir and the source of nearly all water pumped from wells. An estimated 3.5 million acre-feet of good quality water is stored in these deposits and an additional 1.5 million acre-feet in the underlying Dakota Sandstone. Even larger quantities are stored at greater depths in the Paleozoic dolomites and sandstone, but water is of poorer quality. The quantity of ground water pumped is very small compared to the amount in storage.—MCM

02334 **Souther, J. G.** Acid volcanism and its relationship to the tectonic history of the Cordillera of British Columbia: Bull. Volcanol., v. 30, p. 161–176, illus., 1967.

It is shown that the widespread explosive eruption of acid volcanic rocks in the early Tertiary coincides with a period of general uplift, accompanied by intrusion of epizonal acid plutons formed from the same magma. Periodic escape of gas from the top of the magma chambers led to the production of thick piles of ignimbrite. The area underlain by early Tertiary acid volcanics coincides with that of the Whitehorse–Nechako Trough, a belt of prolonged subsidence in which the thickest Mesozoic eugeosynclinal sediments accumulated. Apparently the acid volcanics originated from primary anatectic magma rather than an acid differentiate of a more basic parent.—DBV

Squires, Rodney M. *See* Kvenvolden, Keith A. 02361

02114 **Stanley, Daniel J.; Swift, Donald J. P.** Bermuda's southern aeolianite reef tract: Science, v. 157, no. 3789, p. 677–681, illus., 1967.

The outer reef on the explored southeast margin of the Bermuda platform is a submerged dune ridge thinly veneered with encrusting organisms. Aeolianites were deposited on what appears to be an older truncated surface, the reef-front terrace, now submerged to a depth of about 18 meters. Underwater examination reveals relict features of probable solutional origin that honeycomb the aeolianite and that have undergone only minor modification by erosion since the last eustatic rise of the sea. Submarine planation, even in this marginal area of reef growth, is a relatively slow process.—Authors' abstract

01967 **Stanton, R. L.** A numerical approach to the andesite problem, [Pts.] 1–3: Koninkl. Nederlandse Akad. Wetensch. Proc., Ser. B, v. 70, no. 2, p. 176–216, illus., table, 1967.

Possible mechanisms of lava variation—fractional crystallization, partial melting, contamination, and gas transfer—are examined by a simple numerical treatment of chemical analyses. Composition features of some lava suites, and of Daly's and Nockolds' "averages", show numerical similarity to those expected from gas transfer. Calculations assuming gas transfer indicate: rocks chemically close to Nockolds' tholeiite and Daly's plateau basalt may be the most important parent materials; iron and calcium may be lost during volcanism; olivine basalts may form a residual and andesites a complementary derivative lineage; parental magmas may be thus identified; crystal fractionation would yield materials unknown or rare among lavas; problems posed by other processes may be resolved by induced autocontamination; and andesitic rocks and peridotites of orogenic belts may be complementarily related as derivative and residue.—*from* Author's abstract

02027 **Stauffer, Peter H.** Grain flow deposits and their implications, Santa Ynez Mountains, California: Jour. Sed. Petrology, v. 37, no. 2, p. 487–508, illus., 1967.

The Eocene Juncal, Matilija, and Cozy Dell Formations in the exposed sedimentary sequence along the Pacific Coast are identified as mass flow deposits. Such deposits result from gravity flow of shelf sedimentary strata into a steep sided basin. Evidence of flow origin includes: outsized clasts; thick, massive, ungraded, sharply bounded beds with diffuse flat lamination; dish structure; peculiar types of sole markings; flow structures; lack of turbidite features; and lack of traction current features. Depositional structures are oriented transverse to the basin axis in contrast to those of associated formations whose sedimentary structures are oriented parallel to the basin axis.—RAC

Steele, F. *See* Daniels, R. B. 02198

Stevenson, Anne L. *See* Benninghoff, William S. 02333

11178 **Stewart, W. J.** *Schubertellinae* volfkempa (Nizhnyaya perm') iz gor Franklina Tekhasa: Akad. Nauk SSSR Voprosy Mikropaleontologii, no. 10, p. 80–88, illus., tables, 1966.

Among numerous fusulinids found in the Waco Formation of Wolfcamp age on the west flank of the Franklin Mountains of West Texas, there were several of the genus *Schubertella* with shells varying extremely in shape and size. These are described here as six new species and one new genus, as follows: *Toriyamaia americana*, n.gen., n.sp.; *Schubertella canutillaensis* n.sp.; *S. orbiculata* n.sp.; *S. longissima* n.sp.; *S. provecta* n.sp.; and *S. minima* n.sp.—DBV

11142 **Stheeman, H. A.** Discussion [of "Exploration for natural gas" by E. H. Rainwater, 1966], *in* Natural gas—Inst. Petroleum, Explor. and Production Group, Symposium, London, 1966, Proc.: London, Elsevier Publishing Co., p. 28–30, 1966.

Although differing from Rainwater (ibid., p. 1–31) on such subjects as migration, one of Dr. Stheeman's greatest problems in the North Sea exploration of the Permian was the presence of nitrogen in overwhelming quantities. Concern was with a pure gas below an almost pure evaporite, devoid of terrestrial material, chemically and physically deposited in a very quiet period, with only traces of oil combined with sulphuric gas in dolomite and anhydrite cap rock of gas-bearing continental rocks—Dr. Rainwater's least favorable habitat. The connection between the nitrogen and salt is confirmed, just as that between salt and methane is increasingly apparent in salt domes. The possibility of bacterial generation may explain the relative abundance of gas in similar Paleozoic regions such as Western Canada.—GDC

02144 **Stockman, K. W.; Ginsburg, R. N.; Shinn, E. A.** The production of lime mud by algae in south Florida: Jour. Sed. Petrology, v. 37, no. 2, p. 633–648, illus., 1967.

Estimates are given for the annual production of fine aragonite mud by algae with fragile skeletons from sea floor observations in Florida Bay and the nearshore part of the Florida Reef Tract; comparison of production rates with rates of mud accumulation indicated that one genus, *Penicillus* is a major contributor of fine aragonite mud. It is calculated that the present rate of production by *Penicillus* sp. could account for all fine aragonite mud in the inner Florida Reef Tract and one-third of the material in northeastern Florida Bay since the areas were flooded by rising sea level 4,000 to 10,000 yr ago. Breakdown of resistant skeletons, mollusks, algae, and corals also contributes to the fine lime mud. The similarity in conditions of accumulation of these Recent lime muds and many ancient lime muds suggest that plant and animal skeletons have been major sources in the past.—VSN

Stockwell, H. O. *See* Read, W. F. 11215

Stone, A. V. *See* Nicolay, H. H. 02228

02222 **Stuckenrath, Robert, Jr.** University of Pennsylvania radiocarbon dates X: Radiocarbon, v. 9, p. 333–345, 1967.

This date list includes those series of samples completed as of November 1966. Descriptions are given of archeologic samples from Pakistan, Macedonia, Bolivia, Yucatan, Aleutian Islands, Hawaiian Islands, and islands of the Pacific—Marquesas, Carolines, British Solomons, and New Hebrides.—MCM

02249 **Stumm, Erwin C.; Chilman, Ruth B.** Check list of fossil invertebrates described from the Middle Devonian Silica Formation of northwestern Ohio and southeastern Michigan: Michigan Univ. Mus. Paleontology Contr., v. 21, no. 7, p. 123–137, 1967.

The Middle Devonian Silica Formation is exposed in limestone and shale quarries near Silica in northwestern Ohio. During a 40-year period more than 200 invertebrates have been listed and described from this formation in 68 papers and more are in preparation. Other exposures of this formation are along Ten Mile Creek and at the Whitehouse Quarry, both in Lucas County, Ohio; in a shaft at the head of Belle Isle in the Detroit River; and in a well drilled at Cone, Mich. The formation has been traced as far as Peche Island in Lake St. Clair. The fossils are listed according to phyla and classes, with symbols to indicate those occurring elsewhere in the Silica quarries. The fauna found by Dr. G. M. Ehlers in cores at Belle Isle are not repeated in this paper.—*from* Authors' abstract

02288 **Swain, Frederick M.** Stratigraphy and biochemical paleontology of Rossburg Peat (Recent), north central Minnesota, *in* Essays in paleontology and stratigraphy—R. C. Moore Commemorative Volume: Kansas Univ. Dept. Geology Spec. Pub. 2, p. 445–475, illus., tables, 1967.

Core samples of peat from Rossburg Bog, Aitken County, Minn., were analyzed for total and component organic materials (bitumen, amino acids, carbohydrates, pheophytin and carotenoids), pH and Eh values, and pollen. The stratigraphic sequence, representing approximately the past 11,500 years, consists of postglacial moss peat to depths of 12 to 19 feet (dystrophic bog stage), underlain by copropel-peat to depths of 22 feet or more (eutrophic lake stage), below which lies slightly calcareous oligotrophic organic clay and silt to 27 feet or more, underlain by sand. The stratigraphic distribution of organic residues in the peat and lake sediments shows a relationship to the sedimentary and paleoenvironmental history of the deposits. Although they can be only partly related to specific organisms, the organic residues function as biochemical fossils; hopefully they will be useful as such in studies of older cyclic deposits.—VMJ

01942 **Swift, D. J. P.; McMullen, R. M.; Lyall, A. K.** A tidal delta with an ebb-flood channel system in the Minas Basin, Bay of Fundy—Preliminary report: Maritime Sediments, v. 3, no. 1, p. 12–16, illus., 1967.

Sparker profiles in the Minas Basin, Nova Scotia, show places where presumed glacial till lies directly on the Triassic and is overlain by stratified glacial outwash

deposits. This material is being reworked and the sand and gravel redeposited in lenses. One of the most striking tidal deposits is the Windsor Bay sandbody complex, a tidal delta formed by the Avon River. Much of the surface morphology is similar to the Mississippi delta but a system of mutually evasive ebb and flood channels has been produced. The tide in the main channel continues to ebb for 15 min after the tide has turned in the Basin, so the flood tide flows up the eastern channel. Petrographic and grain-size distribution studies of sediment in the sandbody complex are in progress. Maps showing bathymetry and sediment facies in Windsor Bay are included.—ESL

Swift, D. J. P. *See* McMullen, R. M. 02019

01941 **Swift, Donald J. P.; Borns, Harold W., Jr.** Genesis of the raised fluviomarine outwash terrace, north shore of the Minas Basin, Nova Scotia—A preliminary report: Maritime Sediments, v. 3, no. 1, p. 17–23, illus., 1967.

Three lithosomes may be distinguished in the late Pleistocene outwash deposit forming a terrace between the Cobequid Hills and the north shore of Minas Basin. At Advocate Harbour sea bluffs and sand pits expose the glaciolittoral lithosome, deposited in a wave agitated environment similar to the modern bay, with surface features of the terrace resembling those of the modern harbor. Between Cape Spencer and Five Islands, river valleys are filled with a glaciodeltaic lithosome. Bottomset clay deposits and sand and gravel foreset and topset deposits contain ice contact features. This lithosome is disconformably overlain by a sheet of kettled glaciofluvial gravels exhibiting a relict braided pattern on the surface. The interaction of eustatic sea-level rise and crustal uplift during deglaciation is recorded.—*from* Authors' abstract

Swift, Donald J. P. *See* Stanley, Daniel J. 02114

02009 **Swindale, L. D.; Fan, Pow-Foong.** Transformation of gibbsite to chlorite in ocean bottom sediments: Science, v. 157, no. 3790, p. 799–800, illus., 1967.

Grains of gibbsite surrounded by zones of chlorite were found in six samples of sediment from Waimea Bay off Kauai, Hawaii. Details of the association are described. The gibbsite was formed on land under conditions of strong weathering and strong leaching. When transported to the sea it was deposited in a solution containing silicic acid, magnesium, potassium, and hydrogen ions, in which it is unstable. Chlorite, a stable mineral in this solution, replaced the gibbsite.—DBV

02295 **Sylvester-Bradley, P. C.** Towards an international code of stratigraphic nomenclature, *in* Essays in paleontology and stratigraphy—R. C. Moore Commemorative Volume: Kansas Univ. Dept. Geology Spec. Pub. 2, p. 49–56, 1967.

All nations seem to agree that an international code of stratigraphic nomenclature, analogous to those of botanical and zoological nomenclature, is necessary. To avoid the more contentious areas of disagreement among the national codes, it is suggested that the international code be restricted to chronostratigraphy, as distinguished from lithostratigraphy and biostratigraphy, and further restricted to rock terms, or stratomeres, as distinguished from time terms. The term stratozone is suggested for the smallest rock unit. Importance of uniqueness in definition of stratotypes is discussed; specifications are suggested for type sections and marker points. Methods of forming names for stages and stratozones are discussed; it is suggested that stratozones be named after localities or formations rather than fossils.—VMJ

02202 **Taft, William H.** Physical chemistry of formation of carbonates, Chap. 3 *in* Developments in sedimentology—[V.] 9B, Carbonate rocks—Physical and chemical aspects: Amsterdam and New York, Elsevier Publishing Co., p. 151–167, illus., tables, 1967.

Modern, unconsolidated, carbonate sediments are composed predominantly of metastable carbonate minerals, whereas ancient carbonate rocks are made up of calcite and dolomite. If ancient carbonates were predominantly metastable prior to lithification, then in order to preserve the original textures solid-state

recrystallization must have been operative instead of solution reprecipitation of aragonite to calcite. Aragonite in contact with distilled water completely recrystallizes to calcite in approximately 100 days at 23°C. Recrystallization rate of aragonite to calcite increases with increasing concentration of calcium ions and increasing temperature. Magnesium, on the other hand, retards recrystallization of aragonite to calcite if the weight ratio of aragonite to magnesium is 804 or less.—Author's abstract

Talent, John A. *See* Johnson, J. G. 02404

02217 **Tamers, M. A.** Instituto Venezolano de Investigaciones Científicas natural radiocarbon measurements III: Radiocarbon, v. 9, p. 237–245, 1967.

Reported dates represent a portion of those determined in 1966. Ground water samples are from Venezuela; archeologic samples from Venezuela, Argentina, Chile, and Curaçao; geologic samples from Finland; and miscellaneous samples from Venezuela (sediments and leaves) and Illinois (wood).—MCM

02196 **Tanner, William F.** The ripple mark analog—Preliminary results: Southeastern Geology, v. 8, no. 2, p. 67–72, illus., 1967.

The spool type analog can be manipulated so that various effects, which are inseparable under water, can be simulated individually. Results of such work show that ridge spacing is related directly to grain diameter and efficiency of packing, and inversely to sediment sorting and departure from sphericity. With the model, ridges are produced as a result of transmission of shear-induced stress through those grains lying in front of the advancing spool. Stress transmission failure is realized at points where individual grains, or clusters, are squeezed up out of the bed. Each small heap triggers a skipping motion of the spool, which then begins again to build up a shear on the sand bed. The same mechanism, under water, operates as a result of shear imparted by wave orbital motion or current action. However, under water, eddies develop between shear ridges building them up.—*from* Author's abstract

11168 **Tappan, H.; Loeblich, A. R.** Mikrostruktura stenki rakovin i sistematika nadsemeystve Discorbacea (*Foraminiferida*): Akad. Nauk SSSR Voprosy Mikropaleontologii, no. 10, p. 375–392, illus., 1966.

Changes in the classification of the superfamily Discorbacea are reviewed. The main changes have been the transfer of a number of genera with two layered septa to the superfamily Orbitoidacea, and reestablishment of several genera and subgenera from synonyms, on the basis of X-ray and other new data. Several genera previously referred to the Discorbacea have been transferred to other families and superfamilies.—DBV

02320 **Tater, Thumar Mal.** The Dunvegan Sandstone of the type area [abs.]: Bull. Canadian Petroleum Geology, v. 15, no. 2, p. 215, 1967.

02218 **Tauber, Henrik.** Copenhagen radiocarbon measurements VIII—Geographic variations in atmospheric C^{14} activity: Radiocarbon, v. 9, p. 246–256, illus., 1967.

This list covers measurements of bomb-produced C-14 in series of cereals and grasses collected on the northern hemisphere from 1956 through 1966 to determine the yearly addition of bomb-produced C-14 at a single locality, and to detect possible geographic variations in the distribution and uptake of bomb-generated C-14 in terrestrial plant material during years with greatly varying amounts of bomb C-14. Samples are from Denmark, Norway, Italy, Switzerland, Greenland, Manitoba, Nigeria, Sudan, Pakistan, India, Taiwan, Korea, Hawaii, Mexico, Florida, Panama, Canary Islands, Sweden, and Germany.—MCM

02338 **Taylor, S. R.** The origin and growth of continents: Tectonophysics, v. 4, no. 1, p. 17–34, illus., tables, 1967.

Geophysical, geological, and geochemical evidence for origin and growth of continents is summarized, and a simplified model for the stages is proposed as

follows: Initial geochemical fractionation led to concentration of lithophile elements in the upper 1,000 km; lateral variations in distribution of heat producing elements in the upper mantle localized sites of continental nuclei; continents grew chiefly by addition of andesites and associated calc-alkaline rocks in orogenic areas, granodiorites and granites formed by partial melting leaving a lower anorthositic crust, and the continental crust attained a composition close to that of calc-alkaline or orogenic andesites; the process was terminated by depletion of subcontinental mantle heat producing elements; and erosion of shield areas removed K, U, and Th and has reduced heat flow to levels below those of present orogenic areas.—VSN

02412 **Taylor, Thomas N.** On the structure and phylogenetic relationships of the fern *Radstockia* Kidston: Palaeontology, v. 10, pt. 1, p. 43–46, illus., 1967.

Radstockia kidstonii n.sp., is described from compression specimens in ironstone concretions in the Middle Pennsylvanian Francis Creek Shale of the Carbondale Formation, Mazon Creek locality, Illinois. The specimens are portions of two foliar segments; at least secondary pinnae are represented. The fructifications, apparently produced on all the foliar units, are elliptical bodies, or sori, about 2 mm long, 1 mm wide, partially embedded in the abaxial surface of marginal foliar lobes; structure is not known, as original organic material has been replaced. Spores resemble those of the form genus *Laevigatosporites*. *R. kidstonii* closely resembles certain genera of fossil and living Marattiaceae; it may represent an intermediate form in the shift of the sorus from a marginal to a superficial position on the lamina.—VMJ

Taylor, Thomas N. *See* Eggert, Donald A. 11185

11210 **Taylor, Thomas N.** Paleozoic seed studies—On the genus *Hexapterospermum*: Am. Jour. Botany, v. 53, no. 2, p. 185–192, illus., 1966.

A new species, *Hexapterospermum delevoryi*, is described from several seed specimens collected from Middle Pennsylvanian deposits in southern Illinois. The new species is radially symmetrical, approximately 2.5 cm long and 1.3 cm in diameter at the widest region. Six primary ribs extend from the integument and give the seed the configuration of a hexagon when sectioned transversely. A thin plate of cells is present at the region of the commissure in each of the ribs. Additional features, not included in the original description of the genus, are described including the occurrence of a pollen receiving mechanism consisting of a collar like nucellar extension surrounding a central column. Relationships with other Paleozoic seeds are also discussed. *from* Author's abstract

02280 **Teichert, Curt.** Major features of cephalopod evolution, *in* Essays in paleontology and stratigraphy—R. C. Moore Commemorative Volume: Kansas Univ. Dept. Geology Spec. Pub. 2, p. 162–210, illus., table, 1967.

In the light of recent literature, evolution of the Cephalopoda, from the Late Cambrian ellesmerocerids to the Recent coleoids and *Nautilus*, is discussed in terms of development of major structural innovations in shell morphology. Most major features in cephalopod evolution may be interpreted as responses to the need for buoyancy control. Emphasis is on evolution of characters generally regarded as criteria of ordinal taxonomic rank. Evolution within each order is traced in outline only, if at all, but can be followed on the phylogenetic chart, which shows the relationships of 25 orders and 360 families. Subdivision of Cephalopoda into seven "megataxa," preferably subclasses, is suggested: Orthoceratoidea, Actinoceratoidea, Endoceratoidea, Nautiloidea, Bactritoidea, Ammonoidea, Coleoidea.—VMJ

02292 **Teichert, Curt; Yochelson, Ellis L.** (editors). Essays in paleontology and stratigraphy—R. C. Moore Commemorative Volume: Kansas Univ. Dept. Geology Spec. Pub. 2, 626 p., illus., tables, 1967.

The 24 papers (cited individually) in this commemorative volume are in four groups: nomenclature and taxonomy, paleontology and biostratigraphy, sedimentation and paleoecology, and stratigraphy and correlation. Tributes to R. C. Moore by W.

E. Pratt and M. W. Haas, and by C. O. Dunbar, and a comprehensive subject index are included.—MCM

Teleky, Lorraine S. *See* Dodd, Robert T. 02255

02060 **Terasmae, J.** A review of Quaternary palaeobotany and palynology in Canada: Canada Geol. Survey Paper 67-13, 12 p., 1967.

A review of Quaternary palaeobotany and palynology in Canada shows a development from the early exploratory studies before 1900 to more systematic investigations after 1940. Extensive peat bog surveys in the early nineteen hundreds stand out because of their economic objectives. Since 1930 palynological studies have become dominant over investigations of plant macrofossils. In recent years the potential usefulness of palaeobotanical studies in both physical and biological sciences dealing with our natural environment has been clearly established. The methods used in palaeobotanical research have become more precise and versatile and allow an improved assessment of the basic hypotheses employed in the interpretation of the Quaternary palaeobotanical and palynological record.—Author's abstract

02244 **Thayer, Charles W.** Mud stalagmites and the conulite: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 91-95, illus., 1967.

Morris Cave, Danby, Vt., contains numerous mud stalagmites and a hollow, cone-shaped speleothem for which the term "conulite" is proposed. The mud stalagmites are thought to originate by deposition of insoluble clastic material derived from overhead joints, or from flood-borne sediments. This conclusion is supported by their structure and by similarity of the X-ray diffraction patterns of the mud stalagmite sediment and the insoluble residue extracted from the wall rock. When there is no supply of clastics, a conical depression is drilled by the falling water and then lined with calcite; this lining is subsequently exposed by erosion to produce the free-standing conulite. Partially developed conulites illustrating this sequence were observed in the same cave.—*from* Author's abstract

02266 **Thompson, M. L.** American fusulinacean faunas containing elements from other continents, *in* Essays in paleontology and stratigraphy—R. C. Moore Commemorative Volume: Kansas Univ. Dept. Geology Spec. Pub. 2, p. 102-112, illus., tables, 1967.

Pennsylvanian and Permian fusulinacean foraminiferal faunas of North America were examined for elements possibly derived from faunas that migrated from the western side of the Pacific Ocean or from other directions. All American Permian faunas containing members of Verbeekinidae are assumed to have originated on the western side of the ocean; these include faunas of Chiapas, Mexico; Bell Canyon Formation of western Texas; Madras, Oregon; several faunas in northern Washington; and faunas of numerous limestones of British Columbia. Occurrence of *Neostaffella* in the Pennsylvanian faunas of Ward Hunt Island, Northwest Territories, and northeastern Greenland suggests migration from northern European Russia across or around the Arctic Ocean.—VMJ

11191 **Thompson, M. L.** Rasprostraneniye profuzulinell v Severnoy Amerike: Akad. Nauk SSSR Voprosy Mikropaleontologii, no. 10, p. 126-134, illus., 1966.

The distribution of *Profusulinella* in the United States is shown on an outline map, and the vertical distribution of the various zones of fusulinids in the Pennsylvanian of the United States is shown in a diagram. The geographic and stratigraphic distribution of the individual zones (*Millerella, Profusulinella, Fusulinella, Fusulina, Triticites, Pseudoschwagerina, Paratusulina, Polydiexodina, and Yabeina*) is outlined.—DBV

11163 **Thompson, Morris M.; Lewis, James G.** Practical improvements in stereoplotting instruments, *in* United Nations Regional Cartographic Conf. for Asia and Far East, 4th, Manila, 1964—V. 2, Proc. and Tech. Papers: New York, United Nations, p. 279-287, illus., 1966.

In the United States Geological Survey, the bulk of stereoplotting work for topographic mapping is done with the ER-55 and Kelsh plotters. The improvements implemented to date have affected various components of the plotters, such as the projectors, the projector support system, and the measurement, illumination, electrical-control, image distortion, compensation, and viewing systems. The improvements are not individually spectacular, but have made it possible to keep pace with ever-increasing demands for immediate production of good maps in large quantities.—GDC

02096 **Thrailkill, John.** Deposition in caves—A review [abs.]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 112, 1967.

Tipper, H. W. *See* Frebold, Hans, 02380

02205 **Tobison, N. M.** Geology and development history of Boxer Field, Morgan County, Colorado: Mtn. Geologist, v. 4, no. 3, p. 83-89, illus., 1967.

Boxer Field, currently foremost in daily production in the Denver Basin, is productive from barrier bars in the "D" Sand of the Dakota Formation (Lower Cretaceous). The discovery well was completed in April 1965, but development drilling proceeded slowly until 1967; half of the total of 40 gas and oil wells have been completed in the first half of 1967. Although drilled in a prospect area with an average of one dry hole per section, Boxer Field has over 1600 productive acres to date. Subsurface control in the Denver Basin is adequate to guide geologists in the successful search for similar stratigraphic reservoirs.—Author's abstract

01947 **Todd, Ruth.** Recent literature on the Foraminifera: Cushman Found. Foram. Research Contr., v. 18, pt. 3, p. 137-145, 1967.

02402 **Toomey, Donald Francis; Ham, William E.** *Pulchrilamina*, a new mound-building organism from Lower Ordovician rocks of west Texas and southern Oklahoma: Jour. Paleontology, v. 41, no. 4, p. 981-987, illus., 1967.

A new mound-building organism, *Pulchrilamina spinosa*, n.gen., n.sp., is described from the Lower Ordovician rocks of west Texas (El Paso Group) and southern Oklahoma (Arbuckle Group). This organism, of uncertain biological affinities but possibly related to the coelenterates, is characterized by massive colonial form and laminated growth structure, with hollow spines on upper surfaces of the laminae. *P. spinosa* is the primary framework builder in many of the Lower Ordovician mounds in the El Paso and Arbuckle Groups and is associated with sponges and algae.—*from* Authors' abstract

02335 **Torres H., Francisco.** El problema de la cimentación de la cortina de la presa "Las Tórtolas" [with Portuguese, French, and English abs.]: Ingeniería Hidrául. México, v. 21, nos. 1-2, p. 107-112, illus., 1967.

In Mexico, Las Tórtolas dam is being built on permeable filling more than 150 m below the Nazas River bed. Studies were made to determine the permeability of the alluvials and to project a "floating" type dam that would meet safety and specialized requirements. The riverbanks at the dam location consist of sedimentary rock including permeable calcites and lutites. Treatment of the river bed foundation is being done by flexible "screens" constructed by filling deep trenches with bentonitic clays.—LLP

02186 **Towe, Kenneth M.** Echinoderm calcite—Single crystal or polycrystalline aggregate: Science, v. 157, no. 3792, p. 1048-1050, illus., 1967.

Electron microscopy of natural and broken surfaces of echinoid skeletal plates reveals that the interior portions have the morphology of a single crystal, whereas the exterior is a polycrystalline aggregate with preferred orientation. These data help to resolve earlier contradictory X-ray and optical evidence.—Author's abstract

Traverse, Alfred. *See* Quinlan, James F., 02080

Turek, A. *See* Haugh, I. 02167

Tuttle, O. F. *See* Kuellmer, F. J. 11129

11170 **Tuttle, O. F.; Gittins, J.** (editors). Carbonatites: New York, Interscience Publishers, 591 p., illus., tables, 1966.

This is a compilation of a number of articles dealing with field and laboratory studies of carbonatites and associated rocks, including some current experimental work on carbonatites. The sections of the book are: (1) description of carbonatite complexes in Africa, Germany, Sweden, Norway, and Brazil, (2) fenitization (data from Africa, Sweden, and Norway), (3) experimental studies, (4) economic mineralogy of African carbonatites, and (5) summaries and bibliography of all known carbonatites and bibliography of theoretical, experimental, and general works. Papers by P. J. Wyllie, F. J. Kuellner, J. L. Powell, and J. Gittins are cited separately.—LLP

Ulrich, George E. *See* Klemic, Harry. 02075

11159 **United Nations.** (Dept. Econ. and Social Affairs). Fourth regional cartographic conference for Asia and the Far East, Manila, Philippines, 1964—V. 2, Proceedings of the conference and technical papers: New York, United Nations, 505 p., illus., 1966.

Technical papers of this conference include reports on geomagnetic instrumentation, unified world gravity system, resurvey of the Alaska earthquake disaster area, principles of tsunamis and warning system, stereoplotting instruments, automated mapping systems and analytical aerotriangulation, orthophotography, tri color hue and symbol combinations, physical resources inventory for community development planning, and nomenclature of sea floor features. Eleven of these papers which have geological application have been cited individually.—GDC

U.S. Bur. Commercial Fisheries. *See* U.S. Coast and Geodetic Survey. 02101

U.S. Bur. Commercial Fisheries. *See* U.S. Coast and Geodetic Survey. 02102

U.S. Bur. Commercial Fisheries. *See* U.S. Coast and Geodetic Survey. 02103

U.S. Bur. Commercial Fisheries. *See* U.S. Coast and Geodetic Survey. 02104

U.S. Bur. Commercial Fisheries. *See* U.S. Coast and Geodetic Survey. 02105

U.S. Bur. Commercial Fisheries. *See* U.S. Coast and Geodetic Survey. 02106

U.S. Bur. Commercial Fisheries. *See* U.S. Coast and Geodetic Survey. 02107

02235 **U.S. Bureau of Mines.** Mining and mineral operations in the United States—A visitor's guide: Washington, D.C., U.S. Govt. Printing Office, 90 p., illus., 1967.

This pamphlet gives a brief description and location for mines and plants that can be seen from highways, readily accessible mines that can be visited, and historical sites and ghost towns in each of the states.—LLP

02101 **U.S. Coast and Geodetic Survey; U.S. Bur. Commercial Fisheries.** Bathymetric map, Nantucket Sound and approaches (0708N 51): Washington, D.C., U.S. Coast and Geod. Survey, scale 1:125,000, 1967.

02102 **U.S. Coast and Geodetic Survey; U.S. Bur. Commercial Fisheries.** Bathymetric map, Veatch and Hydrographer Canyons (0708N 53): Washington, D.C., U.S. Coast and Geod. Survey, scale 1:125,000, 1967.

02103 **U.S. Coast and Geodetic Survey; U.S. Bur. Commercial Fisheries.** Bathymetric map, Block Delta and Canyon (0807N 51): Washington, D.C., U.S. Coast and Geod. Survey, scale 1:125,000, 1967.

02104 **U.S. Coast and Geodetic Survey; U.S. Bur. Commercial Fisheries.** Bathymetric map, Hudson Canyon (0807N–52): Washington, D.C., U.S. Coast and Geod. Survey, scale 1:125,000, 1967.

02105 **U.S. Coast and Geodetic Survey; U.S. Bur. Commercial Fisheries.** Bathymetric map, Toms Canyon (0807N–53): Washington, D.C., U.S. Coast and Geod. Survey, scale 1:125,000, 1967.

02106 **U.S. Coast and Geodetic Survey; U.S. Bur. Commercial Fisheries.** Bathymetric map, Baltimore and Wilmington Canyons (0807N–56): Washington, D.C., U.S. Coast and Geod. Survey, scale 1:125,000, 1967.

02107 **U.S. Coast and Geodetic Survey; U.S. Bur. Commercial Fisheries.** Bathymetric map, Block Channel (0808N–52): Washington, D.C., U.S. Coast and Geod. Survey, scale 1:125,000, 1967.

11162 **U.S. Coast and Geodetic Survey.** Tsunami—The story of the Seismic Sea Wave Warning System, *in* United Nations Regional Cartographic Conf. for Asia and Far East, 4th, Manila, 1964—V. 2, Proc. and Tech. Papers: New York, United Nations, p. 183–193, 1966.

The tsunami of April 1946 is distinguished as the worst natural disaster in Hawaii's history and the last destructive tsunami to surprise these islands. The warning system then envisioned became a reality: a new Keller device which provided a continuous, visible seismogram record was installed in seismograph stations of Hawaii and other Pacific points, each equipped with an automatic alarm signal. Four years after the system was put into operation, with headquarters in Honolulu, a submarine earthquake near Kamchatka Peninsula generated a tsunami felt across the Pacific, causing damage in Hawaii but no loss of life. The SSWWS had paid its way and has since expanded widely in area covered, with improvements over the years. Steps are being taken to improve local warning in Alaska.—GDC

01916 **U.S. Natl. Aeronaut. Space Adm.** Earth photographs from Gemini III, IV, and V (NASA SP–129): Washington, D. C., Natl. Aeronautics and Space Adm., Office Technology Utilization, 266 p., illus., 1967.

The photographs in this volume are a part of some significant experimental results which these three global flights produced. Most of them were obtained by Gemini IV and V in a series of terrain photography experiments scheduled to obtain high quality color photos for geological, geographical, and meteorological purposes. Photos of shorelines, river courses, and details never before seen by man are included. Considerable bottom topography and water current structure is visible, making the pictures valuable for studies in oceanography and marine geology. There is stereoscopic coverage of southwestern United States and northern Mexico, as well as photos across the southeastern states and islands of that region and the Pacific.—GDC

02321 **Vagvolgyi, A.** Palynology of type McMurray Formation [abs.]: Bull. Canadian Petroleum Geology, v. 15, no. 2, p. 215, 1967.

02117 **Vagvolgyi, Joseph.** On the origin of mollusks, the coelom, and coelomic segmentation: Systematic Zoology, v. 16, no. 2, p. 153–168, illus., 1967.

Mollusks had a common origin with annelids from nonsegmented, acoelomate ancestors—most likely from ancestral flatworms, as indicated by developmental and structural similarities between the flatworms, mollusks, and annelids, and by the lower level of organization of the flatworms. The coelom is a phylogenetically new structure in the annelids and mollusks and was acquired independently in the two phyla. Annelids developed from the common stock by adoption of coelomic segmentation (eumetamery) through developmental changes affecting growth of the mesoderm bands. The assertion that mollusks had ancestors with coelomic segmentation is contradicted by ontogenetic and anatomical facts. The primitive segmented mollusks, monoplacophorans and chitons, have only pseudometamery: the coelom is not segmented, and segmented organs occur in different numbers and are not always paired.—VMJ

02224 **Valastro, S., Jr.; Pearson, F. J., Jr.; Davis, E. Mott.** University of Texas radiocarbon dates V: Radiocarbon, v. 9, p. 439–453, 1967.

Routine measurements made since preparation of Texas IV (1966) were made on geologic samples from Texas and California, and on archeologic samples from Texas, Oregon, Colorado, Nebraska, Mexico, Colombia, and Rhodesia.—MCM

02173 **vandeKamp, Peter C.** An Archaean marble in northwestern Ontario: Canadian Jour. Earth Sci., v. 4, no. 4, p. 741–744, table, 1967.

Detailed information is given on the "limestone" reported by Hurst, 1929, and referred to by Armstrong, 1960, as locality 39. The marble outcrops on the west side of Setting Net Creek about 125 mi north of Red Lake, is at least 10–15 feet thick, and lies in a series of volcanics and sediments metamorphosed to the upper greenschist facies. Layering parallels the strike of the other beds. Thin sections show a layered mosaic, composed principally of calcite with minor amounts of silicates, graphite, and magnetite; chemical analyses agree with this mineralogy. Sr and Rb are low compared to younger carbonates. A metasedimentary origin, with interbedded limestone and silt as the original sediment is suggested. Primary carbonate sedimentation in the Archean is compatible with evolution of the atmosphere and hydrosphere.—ESL

Vandoros, P. *See* Hurley, P. M. 02043

02358 **vanSchaik, J. C.** Influence of adsorbed sodium and gypsum content on permeability of glacial till soils: Jour. Soil Sci., v. 18, no. 1, p. 42–46, illus., table, 1967.

The permeability of glacial till soil having mainly montmorillonite in the clay fraction was negligible when the exchangeable sodium percentage (ESP) exceeded 15 to 20. Relatively higher permeability values were obtained in soils containing gypsum, but water transmission through such soils was negligible above ESP of 30 to 35. The relative decrease in permeability with increase in exchangeable sodium depends not only on the ESP and electrolyte concentration in the soil solution but is affected by the types of clay minerals. [Samples from five locations in southern Alberta were tested.]—Author's abstract

02342 **VanSchmus, W. R.; Wood, J. A.** A chemical-petrologic classification for the chondritic meteorites: Geochim. et Cosmochim. Acta, v. 31, no. 5, p. 747–765, illus., tables, 1967.

A two-dimensional classification grid based on chemical and petrologic subdivisions of the chondritic meteorites is proposed. This grid extends the current chemical subdivisions to account for varying petrologic (implied metamorphic) properties of chondrites within the primary chemical groups. Six petrologic types are recognized which, together with the five major chemical groups, produce 30 possible chondritic types. Representatives of 20 of these types are known. An appendix giving the extended classification for 460 chondrites is included.—Authors' abstract

VanSchmus, W. R. *See* Dodd, R. T., Jr. 02344

01921 **Varrin, R. D.; Fang, H. Y.** Design and construction of a horizontal viscous flow model: Ground Water, v. 5, no. 3, p. 35–41, illus., 1967.

The horizontal viscous flow model with "infinite" areal extent can be used for almost any well flow problem whether two-dimensional or three-dimensional, steady or nonsteady, single aquifer or multiaquifer. This model can also be used in the field of soil mechanics for subsurface drainage problems. The design includes scale model analysis and the application of conformal mapping techniques in order to simulate an ideal aquifer. Construction, calibration, and test procedures for the model are described. The apparatus has proved to be both a valuable research tool and an excellent teaching aid.—Authors' abstract

Visocky, A. P. *See* Kuellmer, F. J. 11129

11208 **Vitaliano, Charles J.; Cleveland, John H.** Magnesium mineralization, Gabbs, Nevada, *in* Symposium on geology of cement raw materials—Forum on geology of industrial minerals, 2d, 1966, Proc.: Bloomington, Ind., Indiana Geol. Survey and Indiana Univ., p. 173–197, illus., tables [1966?].

The magnesite deposits of Gabbs, an important raw material for oxychloride cement, are confined to the upper plate of the Paradise thrust fault and were formed by hydrothermal mineralization of the Triassic Luning dolomite. The previously metamorphosed dolomite contains widely scattered minerals typical of the green schist facies. The magnesite, occurring as massive-weathering replacement bodies in the dolomite, contains tremolite and forsterite. Emanations from later intrusives have recrystallized the magnesite, and introduced antigorite and more quartz, talc, and chlorite. Heated meteoric solutions, in conjunction with emanations from a granitic magma, are believed to have dedolomitized the carbonate rocks beneath the deposits. At the site of the ore bodies, decreased pressure permitted replacement of dolomite by magnesite.—*from* Authors' abstract

02215 **Vogel, J. C.; Waterbolk, H. T.** Groningen radiocarbon dates VII: Radiocarbon, v. 9, p. 107–155, illus., 1967.

Only dates which have a bearing on archeology have been included in this list. In addition to samples from Europe, north Africa, and the Near East, a few are listed for Broken "K" ranch series, Arizona, and one from Kau district, Island of Hawaii.—MCM

02050 **Vogeltanz, Rudolf.** Ergänzende Mitteilung über Koprolithen-Untersuchungen aus dem Unteroligozän von Nebraska [with English summ.]: Neues Jahrb. Geologie u. Paläontologie Monatsh. 1967, no. 3, p. 188–191, tables, 1967.

Results of two chemical analyses and of diffractometer and thin-section examination of several carnivore coprolites from the Chadron Formation of Nebraska are presented, supplementing a previous communication (ibid., 1965, no. 6, p. 362–371, 1965).—DBV

02120 **Vokes, Emily H.** The genus *Vitularia* (Mollusca: Gastropoda) discovered in the Miocene of southern Florida: Tulane Studies Geology, v. 5, no. 2, p. 90–92, illus., 1967.

The systematic placement of *Vitularia* will probably remain questionable until the type of radula possessed by the group is known. *Vitularia linguabison* is a new species of Miocene *Vitularia* from a roadcut of "Alligator Alley" in Collier County, Fla. The color patterns of *V. linguabison and V. salebrosa* are nearly identical under fluorescent light and both species possess three wide bands encircling the body whorl in the same fashion; however *V. salebrosa* has more strongly developed peripheral nodes. *V. linguabison* has a lower spire and more numerous denticulations than *V. ecuadorana*, and has a smoother surface and more numerous varices than *V. linguabovis*.—LLP

02122 **Vokes, Emily H.** Observations on *Murex messorius and Murex tryoni*, with the description of two new species of *Murex*: Tulane Studies Geology, v. 5, no. 2, p. 81–90, illus., 1967.

Murex messorius, *Murex woodringi*, *and Murex nigrescens* are believed to be names for the same species; since *M. messorius* is the oldest name, it is the one to be used. An examination of a number of shell specimens indicates that the species has a wide degree of variability. A new species, *Murex olssoni*, was discovered in the Miocene and Pliocene (also Recent) of the Caribbean region. Because it is confined to somewhat deeper water, it does not appear with *M. messorius* in the middle Miocene Gatun Formation. A shell discussed by Clench and Perez Farfante (1945) as *Murex tryoni* Hidalgo is believed to be not that species but a new species, *Murex blakeanus* (Recent only). The two new species, *M. olssoni and M. blakeanus*, are described.—LLP

01954 **Waines, Russell H.; Hoar, Florence Grosvenor.** Upper Silurian–Lower Devonian stratigraphic sequence, western Mid Hudson Valley region, . . . , Ulster County,

New York, *in* New York State Geol. Assoc., Guide book to field trips, 39th Ann. Mtg., New Paltz, 1967: New York, City Coll. City Univ. New York, Dept. Geology, p. D1–D28, H1–H3, illus., 1967.

This paper is a description of the stratigraphic units that are encountered in the field trip area as outlined in the accompanying road log. Underlying sequences seem to have been uplifted and folded during the Taconian Orogeny, followed by erosion and more deposition. During Late Silurian and Early Devonian, the region was generally covered by marine waters. The strata of the Upper Silurian and Lower Devonian are relatively uniform in lithology and thickness but some local differences in depositional environment are evidenced.—LLP

01926 **Walker, Hershel.** Saxet Deep Field, Nueces County, Texas, *in* Typical oil and gas fields of south Texas: Corpus Christi, Tex., Corpus Christi Geol. Soc., p. 176–181, illus., tables, 1967.

02350 **Wall, David.** Fossil microplankton in deep-sea cores from the Caribbean Sea: Palaeontology, v. 10, pt. 1, p. 95–123, illus., tables, 1967.

Quaternary is described from three piston cores taken in the Caribbean Sea. Two cores were from the abyssal plain of the Yucatan Basin in the western Caribbean and the third from the Cariaco Trench, a deep water depression lying within the continental shelf off Venezuela. This microplankton includes five new genera and 18 new or reclassified species of dinoflagellates. Its stratigraphic distribution is outlined and its origin and ecology discussed.—Author's abstract

02033 **Warme, John E.** Graded bedding in the recent sediments of Mugu Lagoon, California: Jour. Sed. Petrology, v. 37, no. 2, p. 540–547, illus., table, 1967.

Intertidal sediments of Mugu Lagoon, Calif., contain much graded bedding which is formed largely by burrowing organisms that mix basal lagoon sand with the overlying tidal flat and salt marsh mud. Dense marsh growth inhibits burrowers, causing sediment mixing to diminish and finally cease, thus completing a graded sequence. Biologic energy locally completely changes the initial sedimentary character and destroys primary structures. It may be far more effective than tidal currents in placing sediment on the surface. A rapid sedimentation rate for these deposits is indicated by radiocarbon dating.—EDM

Warne, S. *See* Wolf, K. H. 02182

Waterbolk, H. T. *See* Vogel, J. C. 02215

11133 **Watson, J. W.** The estimation of natural gas reserves, *in* Natural gas—Inst. Petroleum, Explor. and Production Group, Symposium, London, 1966, Proc.: London, Elsevier Publishing Co., p. 32–50, 111–112, illus., 1966.

Original exploration data is a guide to configuration of a gas productive area. While core data represents a small sample of a reservoir, pressure change from drill-stem or production tests can furnish information on an entire drainage area. Non-associated gas production can be controlled; associated gas, saved as energy for production of the oil, may be available after oil reserves are depleted; dissolved gas must be used as the oil is produced, or may be stored. Liquid recovery in retrograde reservoirs is a part of the estimation; gas reserves are categorized as proved, probable, and possible. Two basic methods of estimating are discussed: volumetric and production pressure decline or material balance. The amount of gas lost and used in field operations, and gas equivalent of extracted liquids must be subtracted from total wet gas reserves.—GDC

02369 **Watt, A. K.** Adequacy of Ontario's water resources: Canadian Mining and Metall. Bull., v. 60, no. 664, p. 918–922, 1967.

The availability of fresh water to meet present and future needs in Ontario is of concern to an increasing number of people. Rain and snow are the source of our potable water and provide, on the average, some 180,000 billion gallons of water annually. This amount is reduced to 94 billion gallons a day as a result of the

evaporation and transpiration of surplus stream flow. The water used for domestic irrigation, public supply and industrial purposes amounts to some 7 billion gallons daily at present and will reach 21 billion gallons daily by the year 2000; however, only about one-fifth of the water used is actually consumed, and this, along with the possibilities of water re-use, improves the water supply picture still further.—Author's abstract

11199 **Weaver, Kenneth N.** The state geological survey and the portland cement industry, *in* Symposium on geology of cement raw materials—Forum on geology of industrial minerals, 2d, 1966, Proc.: Bloomington, Ind., Indiana Geol. Survey and Indiana Univ., p. 1–11, illus., table [1966?].

The position of the portland cement industry in relation to other industrial and metallic minerals is discussed. The most important trends within the cement industry, including automation, large equipment, water transportation, distribution terminals, better quality control, efficient dust control, and more liberal use of geology, are outlined and their relationship to the geology of cement raw materials is examined. The state geological survey must understand the geologic and economic ramifications of these trends if it is to aid the cement industry effectively. Some of the most important functions which the state survey can perform as viewed by the cement industry are regional geologic mapping, mineral resources reports, maintenanace of sample libraries, performance of service work, and research on the beneficiation of raw materials.—Author's abstract

02124 **Weaver, W. G., Jr.; Robertson, J. S.** A re-evaluation of fossil turtles of the *Chrysemys scripta* group: Tulane Studies Geology, v. 5, no. 2, p. 53–66, illus., table, 1967.

Fossil turtles previously assigned to *Trachemys* (= *Chrysemys scripta* group) by Hay (1908) are re-evaluated in the light of recent fossil discoveries from Florida. Of the nine species of *Trachemys* listed by Hay, six are placed in synonymy as *Chrysemys scripta petrolei*, a mid-Pleistocene subspecies. Hay's *Trachemys nuchocarinata and T. jarmani* are shown to be *Terrapene and Deirochelys*, respectively. *Trachemys hilli* is believed to be closer to *Chrysemys picta* than to *C. scripta*. Two new fossil species are described from the Pliocene (*C. inflata*) and Pleistocene (*C. platymarginata*) of Florida.—Authors' abstract

02271 **Webster, G. D.; Lane, N. Gary.** Mississippian-Pennsylvanian boundary in southern Nevada, *in* Essays in paleontology and stratigraphy—R. C. Moore Commemorative Volume: Kansas Univ. Dept. Geology Spec. Pub. 2, p. 503–522, illus., 1967.

Investigations of strata close to the Mississippian-Pennsylvanian boundary at numerous localities in Clark and Lincoln Counties, Nev., have yielded faunas of ammonoid cephalopods, brachiopods, echinoderms, bryozoans, conodonts, and revealed lateral persistence of thin marker beds. The system boundary is placed at the top of the *Rhipidomella nevadensis* Zone, which coincides with a notable change in megafossils and conodonts. This zone is confined to the Indian Springs Formation, here separated from the overlying Bird Spring Formation, in the type area but ranges into the lowest Bird Spring in northern Clark County. Ammonoids from two beds near the middle of the Indian Springs are considered Late Mississippian; four species are described from the upper bed at the Apex locality, including *Syngastrioceras walkeri*, n. sp.—VMJ

02134 **Weeks, Lewis G.** Marine geology—Economic problems and prospects: New York Acad. Sci. Annals, v. 136, art. 20, p. 549–574, table, 1967.

It is recommended that the government support marine research which industry will be able to use a decade or more from now when it is ready to develop the mineral, food, energy, and other resources. Important areas of marine research include: basic mapping, stratigraphic research, investigations of physical, physicochemical, biochemical, and electrometric environmental factors, crustal layering, nature of the ocean basins, cause of crustal depressions, uses of ocean water energy, sampling of resources, mining techniques, recovery methods, and metallurgical processes.—LLP

Werner, Marian A. *See* Hill, Thelma P. 01964

02322 **Westgate, John Arthur.** The surficial geology of the Foremost–Cypress Hills area, Alberta, Canada [abs.]: Bull. Canadian Petroleum Geology, v. 15, no. 2, p. 215–216, 1967.

02309 **Weston, Ayla.** Statistical examination of gravity anomalies over preglaciated terrains [abs.]: Bull. Canadian Petroleum Geology, v. 15, no. 2, p. 210, 1967.

02379 **Wetmore, Alexander.** Pleistocene Aves from Ladds, Georgia: Georgia Acad. Sci. Bull., v. 25, no. 3, p. 151–153, illus., 1967.

The bird material in the collection is small in amount but important, as the species represented are the first recorded from the Pleistocene between northern Virginia and northern Florida. Species described are *Anas rubripes*, *Canachites canadensis*, *Meleagris gallapavo*, *Ectopistes migratorius*, and three unidentified passeriform species. The occurrence of *Canachites canadensis*, the spruce grouse, previously reported from the Pleistocene of Virginia, represents the southernmost records for this species, which is now living in northern Alaska and Canada south to Oregon, northern Wisconsin, and Maine.—VMJ

White, Elizabeth L. *See* White, William B. 02097

02098 **White, Elizabeth L.; White, William B.** Dynamics of sediment transport in limestone caves [abs.]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 113–114, 1967.

02022 **White, James R.; Williams, E. G.** The nature of a fluvial process as defined by settling velocities of heavy and light minerals: Jour. Sed. Petrology, v. 37, no. 2, p. 530–539, illus., tables, 1967.

Differences between settling velocities of quartz and tourmaline grains in the same fluvial sand in bottomset and foreset beds may be used to differentiate between the suspension load and the traction load. Differences are greatest for the traction load.—RAC

02097 **White, William B.; White, Elizabeth L.** The speleological approach to limestone hydrology [abs.]: Natl. Speleol. Soc. Bull., v. 29, no. 3, p. 113, 1967.

White, William B. *See* White, Elizabeth L. 02098

02169 **White, William H.; Erickson, G. P.; Northcote, K. E.; Dirom, G. E.; Harakal, J. E.** Isotopic dating of the Guichon batholith, B. C.: Canadian Jour. Earth Sci., v. 4, no. 4, p. 677–690, illus., tables, 1967.

The batholith is composed of seven granitic phases, together with genetically associated porphyritic dikes and cataclastic breccia bodies. Four of the phases form a concentrically zoned pattern, the youngest being in the center. The batholith intrudes Triassic Karnian Stage volcanic rocks, and is unconformably overlain by Middle and Upper Jurassic marine sediments. K–Ar age determination of 24 samples gave a mean age of 200 m.y. No loss of radiogenic argon is indicated. No difference of isotopic age could be detected between the oldest and youngest rocks. The batholith originated by a complicated sequence of magmatic evolution, at a high crustal level, during an interval of geologic time too brief to be detected by this method.—*from* Authors' abstract

01991 **Whitten, E. H. Timothy.** Fourier trend surface analysis in the geometrical analysis of subsurface folds of the Michigan basin, *in* Computer applications in the earth sciences—Colloquium on trend analysis: Kansas Geol. Survey Computer Contr. 12, p. 10–11, 1967.

The folded top of the subsurface Dundee Limestone has been simulated by double Fourier trend–surface analysis on the basis of 504 well logs. Dips were calculated from tangent planes to this simulated surface and were used to calculate scalar descriptors of the folds. The areal variability of the actual folds can be analyzed by trend–surface analysis of the scalar fold descriptors.—Author's abstract

Wilde, G. L. *See* Skinner, J. W. 11193

Wilde, Garner L. *See* Skinner, John W. 02384

Williams, E. G. *See* White, James R. 02022

02195 **Wilson, Edward O.; Carpenter, Frank M.; Brown, William L., Jr.** The first Mesozoic ants: Science, v. 157, no. 3792, p. 1038–1039, illus., 1967.

Two worker ants preserved in amber of Upper Cretaceous age have been found in New Jersey. They are the first undisputed remains of social insects of Mesozoic age, extending the existence of social life in insects back to approximately 100 million years. They are also the earliest known fossils that can be assigned with certainty to aculeate Hymenoptera. The species, *Sphecomyrma freyi*, is considered to represent a new subfamily (Sphecomyrminae), more primitive than any previously known ant group. It forms a near perfect link between certain nonsocial tiphiid wasps and the most primitive myrmecioid ants. Authors' abstract

Wilson, L. R. *See* Branson, Carl C. 02132

02128 **Wilson, R. L.** Polarity inversions of the Earth's magnetic field, *in* Magnetism and the cosmos—NATOAdvanced Study Inst. Planetary and Stellar Magnetism, Univ. Newcastle upon Tyne, 1965: New York, American Elsevier Publishing Co., p. 79–84, illus., 1967.

Rock may become reversely magnetized either by reversal of the polarity of the Earth's magnetic field or by spontaneous self-reversal. Studies of various lava flows in the world (particularly the Columbia Plateau basalts of the United States) have demonstrated a progressive chemical change accompanying changes from normal to reversed lavas. This leads to the dilemma of choosing between field and self-reversal, since chemical changes are usually explained on the basis of self-reversals. It is suggested here that the ancient magnetic field actually reversed its polarity and that the state of oxidation of lavas, for unknown reasons, can be connected with the polarity of the magnetic field.—VSN

02274 **Wilson, Robert W.** Fossil mammals in Tertiary correlations, *in* Essays in paleontology and stratigraphy—R. C. Moore Commemorative Volume: Kansas Univ. Dept. Geology Spec. Pub. 2, p. 590–606, tables, 1967.

The North American provincial age and stage names for the continental Tertiary are based on criteria of stage of evolution of mammals, time of migration, and extinction. The taxonomic unit usually employed is the genus. Correlations between reasonably complete faunas on this continent, or between a local fauna and a standard fauna for a North American provincial age, are accurate within about five million years on potassium-argon time scales; accuracy increases with proximity and decreases in intercontinental correlations. If less than a local fauna is available, there is increased room for error in mistaking certain variables for temporal distinctions. Leading causes of error are unjustifiably precise identification of fragments, and failure to consider fossils as living animals existing in specific local environments or limited geographically by broader environmental controls. *from* Author's summary

01950 **Wise, Charles D.; Gerry, Ephraim.** Directory of ostracode workers: Micropaleontology, v. 13, no. 3, p. 381–384, 1967.

Over four hundred names and addresses have been brought together in an international directory of ostracode workers. The directory includes the names of those who have written papers on ostracodes, those who are currently engaged in research relative to ostracodes, and those who use ostracodes extensively in their work. [An earlier directory was issued in 1962.]—Authors' abstract

02373 **Withrow, Phil C.** The Red Fork Sandstone in the Wakita Trend, Grant and Alfalfa Counties, Oklahoma: Shale Shaker, v. 17, no. 10, p. 198–205, illus., 1967.

In the Wakita Trend, the Red Fork is a lenticular sandstone of Desmoinesian ("Cherokee") age, deposited as an offshore bar and preserved in a narrow band of three distinct sand bodies. Before the Red Fork was deposited, an extensive coal swamp existed; afterwards, the area was uplifted and followed by a period of non-deposition. Differential compaction after deposition should be considered for accurate interpretation. It is necessary to understand the nature of the Red Fork depositional environment, which can be interpreted from available log information, for reservoir exploration over much of the Anadarko Basin. Well spacing in the Wakita Trend is closer than desirable for maximum economic recovery; secondary recovery projects may increase well reserves.—LLP

02066 **Wolcott, Don E.** Geology of the Hot Springs quadrangle, Fall River and Custer Counties, South Dakota: U.S. Geol. Survey Bull. 1063-K, p. 427-442, illus., geol. map, 1967.

The Hot Springs quadrangle is on the southeast flank of the Black Hills. Exposed sedimentary rocks, about 3,000 feet thick, are of Permian through Late Cretaceous age and are locally covered by Tertiary and Quaternary deposits. The southeast regional dip off the Black Hills uplift is interrupted by the Dudley and Cascade Springs anticlines. Subsidence structures attributed to the removal of anhydrite and gypsum by solution from the Minnelusa Formation are present in rocks as young as Early Cretaceous. Sandstone for dimension stone, and limestone, gravel, and sand for aggregate have been exploited and large reserves remain. Gypsum and bentonite, not exploited, constitute potential resources. No oil and gas test wells are known to have been drilled, but closed structural highs present may be favorable for accumulation of petroleum.—DEW

02100 **Wolf, K. H.; Chilingar, G. V.; Beales, F. W.** Elemental composition of carbonate skeletons, minerals, and sediments, Chap. 2 *in* Developments in sedimentology—[V.] 9B, Carbonate rocks—Physical and chemical aspects: Amsterdam and New York, Elsevier Publishing Co., p. 23-149, illus., tables, 1967.

Emphasis is laid upon the basic chemical, organic, and inorganic principles that determine the composition of carbonates. Elemental compositions vary considerably depending on numerous primary and secondary factors. Their significance has been documented by selected published examples. The practical applicability of elemental analyses of carbonates is stressed, and some case histories provide evidence that the chemical make-up of both the carbonates and associated non-carbonate components can be useful indicators of the original environmental conditions. It is hoped that data compiled here are sufficient to stimulate further research in this interesting field of sediment geochemistry.—Authors' abstract

02182 **Wolf, K. H.; Easton, A. J.; Warne, S.** Techniques of examining and analyzing carbonate skeletons, minerals, and rocks, Chap. 8 *in* Developments in sedimentology—[V.] 9B, Carbonate rocks—Physical and chemical aspects: Amsterdam and New York, Elsevier Publishing Co., p. 253-341, illus., tables, 1967.

The increasing emphasis on detailed study of the petrology of carbonate rocks has led to the adoption of a multitude of techniques that are described in a series of widely scattered publications. A selection of these techniques, of proven value in specific studies, has been brought together in this chapter in the hope that they will contribute to carbonate studies in general. In many cases, refinements and an increase in reliability of a particular technique will rest on a simultaneous use of associated methods and modifications to suit specific cases. The interpretation of the analytical results must be based on sound genetic concepts, which in some instances also require new approaches as discussed in other chapters in this book.—Authors' summary

11206 **Wollenberg, Harold A.; Smith, Alan R.** Radioactivity of cement raw materials, *in* Symposium on geology of cement raw materials—Forum on geology of industrial minerals, 2d, 1966, Proc.: Bloomington, Ind., Indiana Geol. Survey and Indiana Univ., p. 129-147, illus., table [1966?].

The concentration of the radioisotopes U, Th, and K in raw materials from cement plants in California and British Columbia were studied, and portland cement from

plants in the United States and Canada was analyzed for radioactivity by gamma-ray spectroscopy. Limestone is the least radioactive major ingredient. Uranium is the major contributor to the radioactivity of limestone, and Th in shale. A correlation is suggested between the amounts of U and MgO in limestones, and between U and Al_2O_3 in shale. The gamma-ray spectrographic evaluations are tabulated.—*from* Authors' abstract

Wood, J. A. *See* VanSchmus, W. R. 02342

02254 **Wood, John A.** Chondrites—Their metallic minerals, thermal histories, and parent planets: Icarus, v. 6, no. 1, p. 1–49, illus., 1967.

Metal grains in 35 chondrites were analyzed with microscope and electron probe. Taenite and kamacite crystals in ordinary, unequilibrated ordinary, and type III chondrites show the same compositional inhomogeneities previously described in octahedrites. Metal grains evolved *in situ* to their present form during cooling from metamorphic temperature. In many chondrites correlations exist between the dimension and central Ni content of taenite and kamacite crystals. Type II carbonaceous chondrites appear to contain no high-Ni metal grains. There are distinct differences between metal grains in the light and dark components of Pantar type chondrites.—JHF

11119 **Wright, H. E., Jr.** Stratigraphy of lake sediments and the precision of the paleoclimatic record, *in* World Climate from 8000 to 0 B. C.—Internat. Symposium, London, 1966, Proc.: London, Royal Meteorol. Soc., p. 157–173, illus. [1966?].

In paleolimnology, geomorphic features may be useful in the identification of former stages of high lake level, but do not always involve sediments with organic material for radiocarbon dating, thus restricting chronology. Lake-bottom deposits record changes of basin hydrology, water chemistry, and flora and fauna, as they reflect environmental and climatic changes. Postglacial pollen sequences for parts of the United States, especially in the Minnesota area, now available in detail comparable to those of Europe, establish basic stratigraphy, but faunal tests, as well as chemical constituents may soon replace them as paleoclimatic indicators. Pollen and seed diagrams from scattered sites are redrawn from several authors for comparison, but the prairie border of Minnesota holds more promise.—GDC

Wright, Thomas L. *See* Häkli, T. A. 02325

11197 **Wyllie, P. J.** Experimental studies of carbonatite problems—The origin and differentiation of carbonatite magmas, *in* Carbonatites (O. F. Tuttle and J. Gittins, editors): New York, Interscience Publishers, p. 311–352, illus., tables, 1966.

From the experimental data, it is concluded that many of the features of carbonatite complexes can be explained in terms of carbonatite magmas and that many processes and products are possible during the development of carbonatite magmas. The geological history of a carbonatite alkaline complex is undoubtedly complicated. Repeated intrusion of a fluid, reactive, volatile-charged carbonatite magma may be followed by differentiation, the action of vapors and solutions given off by the crystallizating carbonatite or emanating from greater depths, metasomatism occurring within and around the complex, and the development of explosion breccias with pressure changes on the magma at greater depth. Superimposed on these effects may be the effects of remobilization, plastic flow, later metamorphism, shearing and recrystallization.—*from* Author's summary

02113 **Wyrick, Granville G.** Water-bearing characteristics and occurrence of aquifers in Martin County, North Carolina: U.S. Geol. Survey Hydrol Inv. Atlas HA-264, scale 1:125,000, text, 1967.

Sedimentary rocks underlying Martin County thicken from west to east from about 400–1,000 feet; ranging in age from Cretaceous to Recent, the sediments are clay, sand, shell, and limestone deposited on crystalline basement rock. Pre-Miocene sediments strike NNE and dip SE, whereas Miocene and younger are generally horizontal. Principal aquifers are seven sand, shell, or limestone beds; water in the lower six occurs under artesian, and in the seventh under water-table conditions.

Average transmissibility of the artesian aquifers ranges from 4,000 gpd/ft in Aquifer 4 to 18,000 in Aquifer 3. Average daily recharge is computed as 22 million gpd for aquifers between 100 and 300 feet below land surface.—MCM

02220 **Yamasaki, Fumio; Hamada, Tatsuji; Fujiyama, Chikako.** RIKEN natural radiocarbon measurements III: Radiocarbon, v. 9, p. 301–308, 1967.

This continuation of work presented in RIKEN II (1966) lists geologic samples from Japan and Quebec, and archeologic samples from Japan, Korea, and Tanzania.—MCM

02138 **Yasso, Warren E.** Plastic-tube technique for coring unconsolidated wet sand—A discussion [of paper by D. E. Shier and R. Q. Oaks, 1966]: Jour. Sed. Petrology, v. 37, no. 2, p. 714–715, 1967.

Shier and Oaks' account of a plastic-tube coring technique for unconsolidated wet sand (ibid., v. 36, p. 241–244, 1966) is supplemented from the author's experience. A vacuum to ensure core retention can be obtained by using a cloth covered, inner cylinder, inserted in the upper part of the coring tube and pulled upward as the coring tube is withdrawn from the sand, or by capping the coring tube with one hand as the tube is withdrawn.—EJC

02279 **Yochelson, Ellis L.** Quo Vadis, *Bellerophon*?, *in* Essays in paleontology and stratigraphy—R. C. Moore Commemorative Volume: Kansas Univ. Dept. Geology Spec. Pub. 2, p. 141–161, illus., 1967.

Bellerophon de Montfort, 1808, is the first named Paleozoic gastropod, with similarities to pleurotomariaceans, though for many years its biologic placement was confused. Over the years, more than 70 valid genera of bellerophontiform shells, coiled in a bilateral plane, have been named. It is argued that not all bellerophontiform shells are necessarily related to *Bellerophon*. A Cambrian stock, including *Helcionella*, having simple shells with rectangular cross section and straight apertures, may have been an independently evolving line of mollusks, not related to gastropods. A mid-Paleozoic stock, including the Devonian *Cyrtonella*, also have straight apertures; multiple pairs of muscle scars on the dorsum indicate that the animals had not undergone torsion of the soft parts, and therefore were not Gastropoda but Monoplacophora.—*from* Author's summary

Yochelson, Ellis L. *See* Teichert, Curt. 02292

02282 **Yole, R. W.** A faunal and stratigraphic study of upper Paleozoic rocks of Vancouver Island, British Columbia [abs.]: Bull. Canadian Petroleum Geology, v. 15, no. 2, p. 209–210, 1967.

York, D. *See* Gittins, J. 02166

02304 **Young, F. G.** Elkton reservoir of Edson gas field, Alberta: Bull. Canadian Petroleum Geology, v. 15, no. 1, p. 50–64, illus., tables, 1967.

The Edson gas field of west-central Alberta comprises two separate reservoirs, a Cretaceous Bluesky pool, and a much larger Elkton pool in the Mississippian Turner Valley Formation. The Elkton pool is trapped in the extreme up-dip portion of tilted erosionally truncated beds of the Elkton member. Jurassic shale overlying a mature eroded surface forms the cap rock. The reservoir rock consists mainly of vuggy fine-crystalline dolostone which grades vertically into impermeable argillaceous dolostone. Porosity consists of vugs formed by leaching. The leaching and dolomitization processes affected the calcareous sediments soon after deposition. The excess magnesium ion may have been derived from dense brines and migrated laterally and downwards via seepage refluxion.—*from* Author's abstract

02313 **Young, Frederick G.** Petrology of the Deschambault Formation, Trenton Group, St. Lawrence Lowland of Quebec [abs.]: Bull. Canadian Petroleum Geology, v. 15, no. 2, p. 212, 1967.

01935 **Young, W. H.** Thickness of bituminous coal and lignite seams mined in 1965: U.S. Bur. Mines Inf. Circ. 8345, 18 p., tables, 1967.

The number of mines, production, output per man-day, and average thickness of bituminous coal and lignite seams mined in the United States are tabulated by States and type of mine—underground, strip, and auger. Cross-classifications of data are tabulated.—ERL

02296 **Youngquist, Walter.** Fossil systematics, *in* Essays in paleontology and stratigraphy—R. C. Moore Commemorative Volume: Kansas Univ. Dept. Geology Spec. Pub. 2, p. 57–62, 1967.

Problems in classification of conodonts are discussed, as an illustration of problems of taxonomy in invertebrate paleontology as distinct from biology. Classification systems used for living animals, especially those based on soft parts, cannot be used for fossils because of: missing soft parts of the animal; fragmentation and dissociation of hard parts of the whole animal, necessitating classification systems for the individual parts; and importance of index fossils in stratigraphic correlation, resulting in adoption of arbitrary classification systems more practical for this work than attempted natural systems. No one system of classification is likely to satisfy all requirements.—VMJ

02039 **Zarrella, W. M.; Mousseau, R. J.; Coggeshall, N. D.; Norris, M. S.; Schrayer, G. J.** Analysis and significance of hydrocarbons in subsurface brines: Geochim. et Cosmochim. Acta, v. 31, no. 7, p. 1155–1166, illus., table, 1967.

Spectrophotometric and gas chromatographic methods for the analysis of minute concentrations of hydrocarbons dissolved in water and brines are described and applied to studies of the amounts and distributions of dissolved hydrocarbons in subsurface waters. Analyses of brines from oil-producing wells indicate the variability in benzene concentration in waters surrounding different types of hydrocarbon accumulations. Benzene is specific for reflecting the occurrence of an oil accumulation in the tested formation. This provides a direct method of oil exploration and a research technique for evaluation of oil migration and accumulation mechanisms.—DBV

01945 **Zeitner, June Culp.** America's scenic rocks: Gems and Minerals, no. 359, p. 14–18, illus., 1967.

Learning the geology of scenic areas adds greatly to the pleasure of traveling. Examples are given of thrust faulting, badland areas, natural bridges, canyons, caves, the work of ice, earthquakes, and volcanoes. A list of recommended reading is included.—ESL

02370 **Zen, E-an.** Time and space relationships of the Taconic allochthon and autochthon: Geol. Soc. America Spec. Paper 97, 107 p., illus., geol. map, 1967.

The Taconic sequence, which extends from Sudbury, Vt., to Poughkeepsie, N. Y., in the axial region of the Middlebury synclinorium and its southward extension, has three lithostratigraphic groups: (1) the pre-Normanskill "low Taconic" sequence, (2) the Normanskill Shale, and (3) the "high Taconic" sequence. Rocks of group (2) beyond the areal confines of (1) are autochthonous. Rocks of group (1), group (3), and part of group (2) are interpreted as allochthonous. The present Taconic allochthon is marked by negative gravity anomalies and the Green Mountain–Berkshire massif by positive anomalies. It is proposed that this is a result of a deep-seated transfer of material causing the rise of the Green Mountains Berkshire Highlands area and the subsidence of the Middlebury synclinorium area.—LLP

01925 **Zimmerman, U.; Münnich, K. O.; Roether, W.** Downward movement of soil moisture traced by means of hydrogen isotopes, *in* Isotope techniques in the hydrologic cycle—Symposium, Univ. Illinois, 1965: Am. Geophys. Union Geophys. Mon. Ser., no. 11, p. 28–36, illus., table, 1967.

Measurements reported show that movement of soil moisture is layered. A single rainfall, artificially spiked with isotope tracer, will form a tagged layer of water which moves downward as a distinguishable boundary between older rainwater below and younger rainwater above. After a certain time and a corresponding displacement of the tracer peak, a balance can be drawn between incoming rain (corrected for runoff) and water remaining in the soil and eventually yielding groundwater, the difference being evaporation loss. Fine grain soils show average draining velocities below 1 m per year so the method gives accurate values only for periods of a few months. The method should provide detailed information on water balance without disturbing natural conditions and should be applicable everywhere at low cost.—*from* Authors' abstract

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